NATIONAL PETROLEUM NEWS

April 3, 1946

TECHNOLOGY DEPT!

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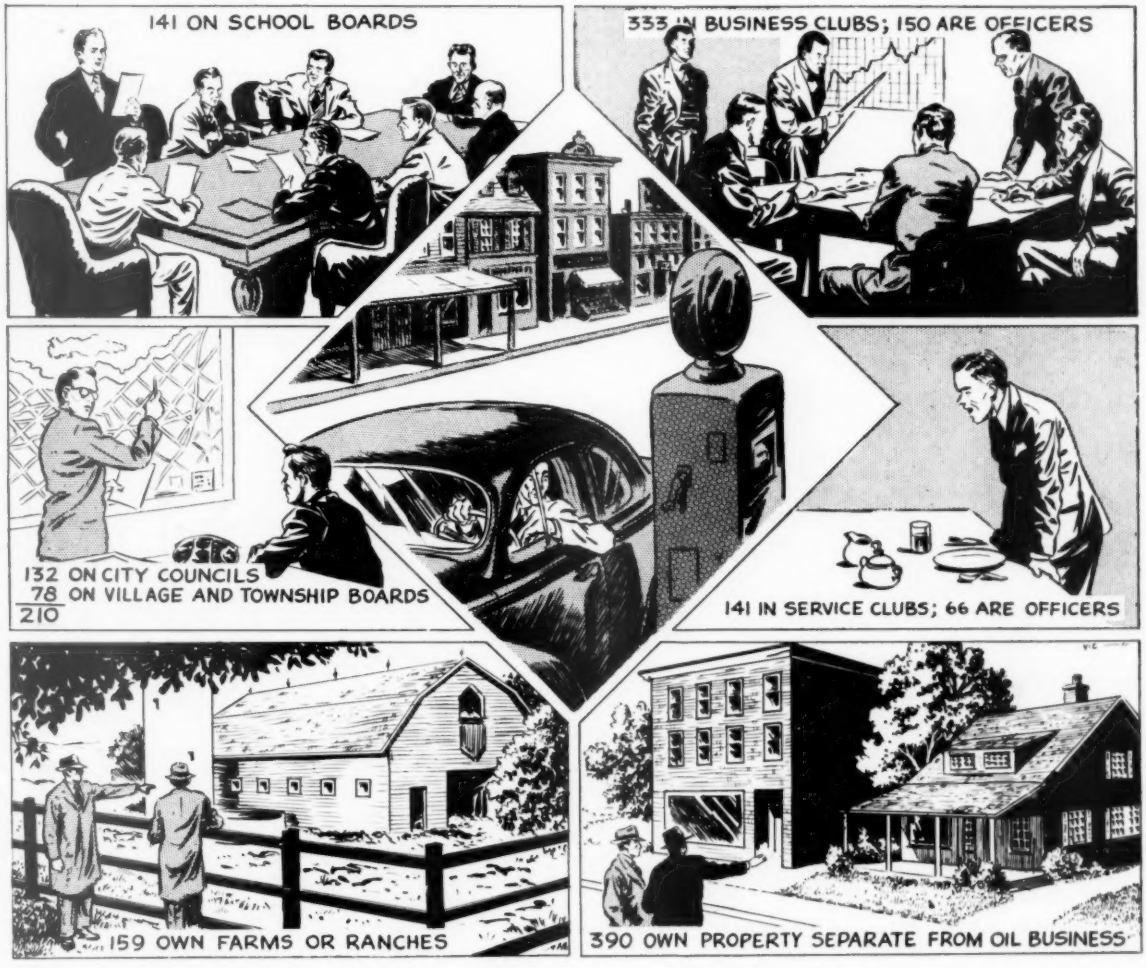
DETROIT

Independent Jobber Is Power in His Community, Association's Survey of 450 Nebraskans Shows


141 ON SCHOOL BOARDS
333 IN BUSINESS CLUBS; 150 ARE OFFICERS
132 ON CITY COUNCILS
78 ON VILLAGE AND TOWNSHIP BOARDS
210
141 IN SERVICE CLUBS; 66 ARE OFFICERS
159 OWN FARMS OR RANCHES
390 OWN PROPERTY SEPARATE FROM OIL BUSINESS

The vibrant influence of the Independent Oil Jobber on the affairs of his home town is fully realized in the returns to a questionnaire sent to Nebraska Independents by their Nebraska Petroleum Marketers Assn. and conducted by H. H. Hahn, executive secretary. They are members of school boards, service clubs, chambers of commerce, city councils and many other civic organizations. And their neighbors are their customers as evidenced by the fact that Independent jobbers in Nebraska distributed 63.5% of all gasoline sold in the state during 1945; 75.2% of the kerosine; 69.7% of the tractor fuel and 80.6% of miscellaneous products. See p. 26.

SALES STIMULANT—Frank Bean has become "John Q. Public" since publication of his article in NPN Feb. 6. Oil management is using reprints of this article to put across the fact that stations must be in good order to escape public disapproval and resulting loss of business. Ninth in NPN's "Station Service for Profit" series. See p. 22.

AIR, SEA AND LAND SERVICE—Miami Aviation Center project will service aircraft, boats and automobiles. See p. 30.

Text of Veterans' Housing Program Order 1 starts on p. 32. Forms for building authorization are reproduced on p. 36 and 37.

v R v 38² April - June 1946

There's one sure thing in the oil business — you've got to figure on a heap of unseen expenses cropping up in the years ahead. Things like wages, cost of materials, weather and corrosion can make or break your petroleum enterprise. But there is one way you can satisfy yourself about your long-term investment . . . specify Morrison precision built equipment and get sturdy, dependable products that are built to stand up under years of rough usage. Behind the superior performance of Morrison oil equipment are 90 years of craftsmanship devoted completely to petroleum distribution.

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OIL EQUIPMENT HEADQUARTERS
DUBUQUE, IOWA

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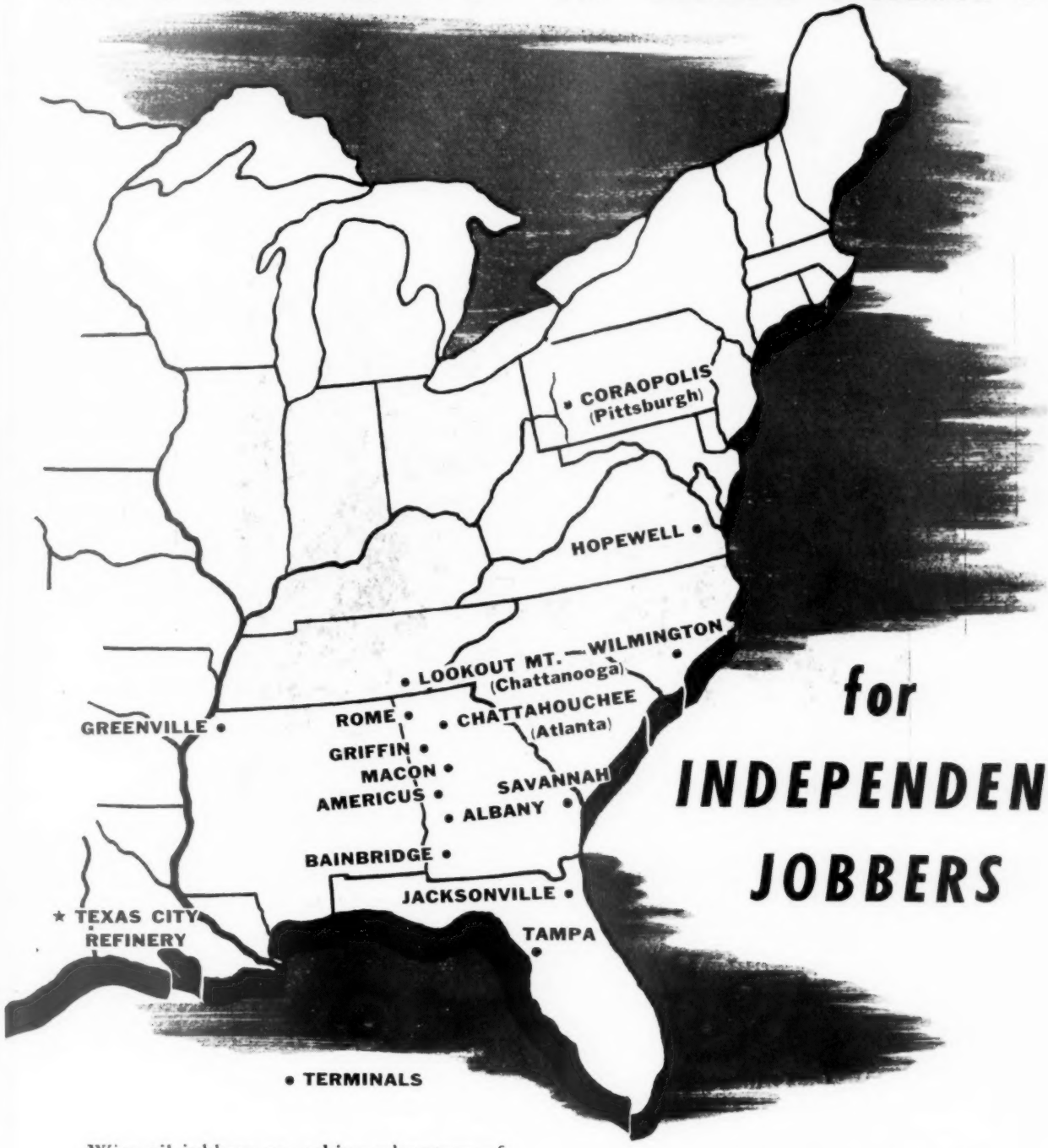

for INDEPENDENT JOBBERS

Wise oil jobbers are taking advantage of Republic's efficient, complete service!

You can profit from our modern production, transportation and marketing facilities. If you're interested in a clear track for more profit in the future, inquire about how Republic can serve you.

REPUBLIC OIL

REFINING COMPANY

BENEDUM TREES BUILDING
PITTSBURGH, PENNSYLVANIA

Frank Porter Heads Activities of Mid-Continent Oil & Gas Assn.

Frank M. Porter

The oil life of Frank M. Porter, sixth president of the Mid-Continent Oil & Gas Assn., started 30 years ago at Ardmore, Okla., with the Dundee Petroleum Co. Two years later he went to work for Wirt Franklin, prominent individual operator in the southern Oklahoma fields. And when the Wirt Franklin Petroleum Corp. was formed in 1927, Mr. Porter became vice president and was in charge of oil production operations.

After this company and an associated concern, the Cromwell-Franklin Oil Co., went into a receivership, Mr. Porter was appointed receiver and later general manager after the companies came out of receivership.

Joining with the late Leslie Fain of Oklahoma City in 1939, the Fain-Porter Drilling Co. was formed and after Mr. Fain's death in 1944, Mr. Porter acquired all of the Fain interests. He is now sole owner.

Not confining himself to drilling alone, he has acquired oil royalty and production interests as well. He has been active in the Independent Petroleum Assn. of America, the American Petroleum Institute and the American Assn. of Oilwell Drilling Contractors. In 1943 he became president of the Kansas-Oklahoma Division of the Mid-Continent Oil & Gas Assn. and is now serving his third term in that office.

Born and educated in Brooklyn, N. Y., he went west in 1916 and now lives and works in Oklahoma City. He has three daughters.

CONTENTS

Advertisers' Index	54
Coming Meetings	56
Editor's Page	7
Markets	44
Oil Prices	46
Personals	56
Statistics	52
Welcome Back	55

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NATIONAL PETROLEUM NEWS
NPN
NEWSMAGAZINE FOR OIL MANAGEMENT MEN

Oil Industry Awaits CPA Clarification Of Building Order as Confusion Mounts

Even Agency Officials Cannot Agree on What It Means; No Exemption for Facilities to House Research Labs

One week after the issuance of Veterans Housing Program Order 1 the oil industry still did not know what effect the order would have upon the industry's development in the coming 12 months, nor did it know the extent to which this new phase of Washington rule-writing would regiment and stifle petroleum and all other industry.

But oil men apparently were no less confused than the Civilian Production Administration itself which issued the order on March 26, effective the same day, for the announced purpose of speeding home-building.

Some Optimism Expressed

A bright spot was the feeling of the oil industry that if the order is clarified and if it is administered wisely, it should not interfere with most petroleum facility building because neither the materials nor the types of labor used in oil construction are generally useful in home-building. Otherwise, however, the situation, as it affects oil, is this:

1. The order badly needs to be clarified. In face of a statement by a CPA official that the order is so clear that further interpretation is not necessary, other CPA men placed varying interpretations upon sections of the order.

2. The best legal men in the oil industry gave divergent opinions as to what is prohibited under some sections of the order, particularly those affecting refining and marketing. (See p. 4)

3. It is fairly certain that drilling of oil wells does not come within prohibitions of the order. (The text of the order, however, only says "wells" in its list of exemptions.)

4. Vast research programs announced by several major oil companies were thrown into a tailspin, at least temporarily, because the order makes no exception for buildings to house research laboratories. The industry saw the possibility of a studied effort by the government thus to short-change private research so as to give an advantage to government-financed and government-controlled research. The government would be free, under the order, to construct any size of research building.

5. Oil industry objections to the order were outspoken. A summary of industry opinion is that there is great need for more homes for veterans, but that CPA will not help achieve this goal. It will, on the other hand, impose unnecessary restrictions upon industry, cause unemployment particularly among veterans, curb technological progress and thus prevent reduction of operating costs. (See p. 5)

Text of Veterans Housing Program Order 1 starts on p. 32 of this issue of National Petroleum News. Facsimiles of application for permission for building work not exempted by the order appear on p. 36 and p. 37.

Ask Decision on Equipment

In an effort to obtain clarification of the effect of the order, NATIONAL PETROLEUM NEWS submitted a list of a service station and bulk plant equipment to two CPA officials and two prominent oil industry attorneys. The question was whether the cost of such equipment would be included in the $15,000 limitation for bulk plants and the $1000 limitation for service stations.

The list follows:

Bulk plants—air compressors, canning equipment, conveyors, drum cleaning equipment, filling equipment, gate valves, instruments, meters, mixing kettles, mixing tanks, motors, pipe, pumps, storage tanks, valves.

Service stations—air compressors, air stands, battery charger, battery tester, brake tester, car washing equipment, floodlight poles, gear case flushers, greasing equipment, lubesters, motor analyzers, motor flushers, oil dispensers, reels (hose), signs, storage tanks and unit heaters.

Declines to Make Ruling

Matthew Hale, Assistant CPA Legal Counsel, thought "most" of the items were exempt, but he declined to rule specifically on each item. He promised, however, to give such specific interpretations to oil companies. (See article in box on this page.)

C. R. Heller, chief of CPA's Equipment Section, thought that at least the cost of installing the enumerated items would have to come within the $1000 and $15,000 limitations. He was optimistic, however, that district CPA director would be lenient in approving applications by bulk and gasoline station operators, stating "these are the kind" of applications which would get approval.

Oil Industry Attorneys Comment

One of the oil industry attorneys said this about the list:

"As regards bulk plants, following are nonexempt: air compressors, canning equipment, drum cleaning equipment, filling equipment, mixing kettles, mixing tanks and motors. Exempt, by definition, are conveyors. The status of instruments, motors, pipe and valves is dependent on the kind of installation and supplement equipment that indicates whether they are part of original structure.

"Non-exempt items in service stations include air compressors, tower air stands, brake testers, car washing equipment, floodlight poles. Battery testers are exempt. Unit heaters are exempt if not attached; if with central heating, they are non-exempt. As for gear case flushers, greasing equipment, lubesters, motor analyzers, motor flushers, oil dispensers, hose reels and signs—if they are on hand trucks or otherwise portable they are exempt. Otherwise, if tied down with bolts, nuts or screws, they are not exempt."

The other gave his opinion that all items would be construed as exempt with the exception of storage tanks and unit heaters, regarding which he felt the order was not clear. He felt the enumeration of certain items of exempt equipment in the order was indicative of a class, and not intended to exclude things not mentioned.

Meanwhile, CPA prepared a form on which applications for exemptions may

Write for Legal Interpretations

WASHINGTON—Oil companies wishing specific legal interpretations as to what equipment falls within the restrictions of Veterans Housing Program Order 1 may write to:

Matthew Hale
Assistant CPA Legal Counsel
Room 5509, Social Security Bldg.
Washington, D. C.

Mr. Hale declined to pass upon a list of service station and bulk plant equipment and service items, but promised that specific legal interpretations will be made to oil companies that write to him. He said that companies may bypass district CPA construction offices and write directly to him.

be made and proceeded with setting up district directors, most of them locating in present FHA field offices in cities designated as CPA district construction headquarters. (For list of cities see NPN, March 27, p. 4.)

It was made clear by CPA at Washington that the district officials will be sole judge on essentiality of non-housing construction,.

The nub of many disagreements as to what the order meant was interpretation of the definitions of "structure" in Section 4700.1-b-(1), of "fixture" and "mechanical equipment" in section 4700 .1-b-(3).

Though the official CPA attitude was that no explanations are necessary, the agency prepared to issue at least two pamphlets which apparently will seek to clear up some of the many questions raised. One would be in question-and-answer form and would relate to construction and installation of equipment. The other would guide district CPA officials and advisory committees in judging essentiality of projects submitted to them.

CPA took the attitude that complaints that the order will paralyze all industrial and commercial construction are premature.

CPA Says Oil Wells Are Exempt

NATIONAL PETROLEUM NEWS asked CPA about the section which states that "wells" are not included within definition of word "structure". CPA said that this obviously means that oil well drilling is exempt from the ban; also that the word "structure" means a "building" and that oil derricks therefore are not affected.

Similarly, CPA stated that "pipe lines" in same section includes those transporting oil. Lines themselves thus are exempt from the ban, although building to house pumps would come under restrictions if total cost of building, not including cost or value of equipment and cost of labor for installing equipment, exceeds $15,000.

In the same connection, CPA Administrator Small volunteered to a press conference, in discussing types of construction exempt from the order, that "petroleum tank farms" fall into this exempt classification. It was not clear, however, whether all oil storage tanks wherever located are excluded from restrictions, even though the logical deduction is that they would be.

The apparent unfamiliarity of CPA officials with the oil industry, as reflected by statements made by them, caused considerable uneasiness within the industry. It was obvious that, in most cases, the industry would have to try to present arguments in favor of needed construction to those who did not understand the complexities of the operations and the economics of petroleum.

As far as NPN could learn, no oil industry man was consulted in preparation of the order, which was issued on March 26, and effective the same day.

Disagreements Among Oil Attorneys Emphasize Ambiguities in Government Building Order

To get interpretations of CPA's Veterans Housing Program Order 1, National Petroleum News had staff reporters in three of its news bureau cities—New York, Chicago and Cleveland—interview outstanding oil attorneys. The opinions of the men interviewed vary widely, pointing up the ambiguity of the order.

NPN News Bureau

NEW YORK—Attorneys for several major oil companies, interviewed here by NATIONAL PETROLEUM NEWS, were generally less pessimistic than marketing executives as to the effect of Veterans Housing Program Order 1, but they agreed that the order is ambiguous and confusing.

They admitted much proposed construction in oil industry will be held up, at least temporarily, and that long delays are likely in approval of applications for building research facilities. Legal representative of George Fuller Construction Co., which has contract for huge new research center of Standard Oil Co. (N. J.) at Linden, N. J., said this project will probably not be interrupted.

"It is not CPA's intent to halt non-residential building," he said, "if work has been started and you have materials on the site. In my opinion CPA will probably be liberal in granting new applications. An oil company will have to show two things. First, that it is essential. Most such companies are. Secondly, it must show the project cannot be deferred. If the oil company has made contracts, purchased land, etc., it has a good chance to prove its case. In areas where material is plentiful, CPA will probably be liberal."

Research Labs in Doubt

Meanwhile, pending further amplification of order, it is still uncertain whether work can be begun on Socony-Vacuum's $1,000,000 research and development laboratory at Paulsboro, N. J.; Sinclair's proposed several-million dollar research and laboratory at Harvey, Ill., and Shell's new lubricating oil plant at Houston.

Attorney for one major company said it is revising some of its research projects to bring buildings within $15,000 exemption. Lawyer for another major said order will "seriously interfere" with research.

One attorney said order is "clear, generally speaking." Another said it is "generally understandable—written in language a layman can read." Both said there are certain "borderline cases" which will require interpretation. Thus pumps in bulk plants, according to first attorney, appear to be excluded from provisions of order by comparison with other wording, but this is not certain. Second attorney opined all pumps are excluded from limitations, since they are not attached to structures. A third company attorney said there is ambiguity as to whether tanks in bulk plants come within order, also that there is question whether it applies to piers and docks in terminals.

Attorneys seemed unanimous that all kinds of wells will be exempted, as will all pipelines.

"By No Means Clear"

Foregoing comparatively cheerful analyses of order were disputed by legal staff of another major company which met to study order, paragraph by paragraph. Spokesman for this group of several attorneys said order is "lengthy, involved and by no means clear. It means you have to get permission for everything you want to build, and that will depend, primarily, on Washington. It may throw virtually all new construction into next year."

He pointed out it is unclear whether underground tanks are exempt or non-exempt, and that it is impossible from text to determine position regarding units in integrated terminal or bulk plant where work has already been started.

* * *

NPN News Bureau

CLEVELAND — The oil industry cannot be certain of what construction will be allowed under the new CPA order, until specific interpretations of ambiguous terms are made available, M. E. Newcomer, Cleveland oil attorney and member of the firm of McAfee, Grossman, Hanning & Newcomer, told National Petroleum News. However, he said if the order is interpreted in light of objectives sought, many types of oil construction can be authorized in producing, refining and distribution.

Everyone agrees on pushing veteran housing, Newcomer said, but there is much refinery equipment, bulk plant construction and possibly research and service station building where neither the type of materials nor the labor to be employed, is of the kind used in home construction. The theory of channeling labor into home construction never works, he said, since labor cannot be "channeled" where it does not wish to go.

If reasonably interpreted, he believes, the order exempts all oil pipelines, oil wells, distilling and cracking equipment —the latter as belonging to the same class as "blast furnaces," mentioned in the order and involving much "process piping," also one of the enumerated exceptions.

Whether intentionally or not, he said, it appears pumping station buildings,

bulk plants, and research laboratories are within the restrictions, and applications would have to set forth sound reasons for granting a building permit. But he pointed out that laboratory equipment is specifically exempted, and that buildings to house the equipment should be granted as a matter of course.

As to service stations, he pointed out that they use very little lumber, and often require glazed brick, and a kind of steel not suited to small dwelling construction. As to driveways, he observed that the order exempts roads, sidewalks and streets, and that if there is no shortage of asphalt and cement, there should be no reason to forbid their construction.

Oil industry construction, he said, could make its best case on the ground that it does not interfere with the Veterans' Housing Program.

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NPN News Bureau

CHICAGO—Examination of text of CPA housing order by an oil company attorney here, reveals, he said, several ambiguities and uncertainties, but effect of the order on industry work stoppage will be vast. He made these points:

1. It throws construction right back where it was when WPB instituted L-41, except that conserved material will be channeled toward building new homes instead of aiding industry in war.

2. Each capital investment greater than $1000 for service station or $15,000 for bulk plant, refinery laboratory, pump house or other building is restricted or subject to special permit authorization. This immediately stops the addition of service station work stalls, display rooms and other similar jobs planned by oil marketing as few can be done for $1000. Repairs to present buildings are not affected, but past practices in each company's bookkeeping must be followed as to whether a job is chargeable to repair expense or is capitalized. Same applies to bulk plants and other buildings and structures covered by the order.

Each Building Not Separate

3. On new jobs composed of more than one building, overall cost determines whether or not it comes within the $1000 or $15,000 limits; that is, each building cannot be classified as a separate construction job to put them under either of the dollar limits. Moreover, if construction of one of the buildings only was started before March 26, then that work alone can go ahead. Other buildings require special permit; that is, starting of one structure before March 26 in a multiple job does not constitute starting of work on all under the order.

Excavation does not constitute starting; foundation or other portion of material must have been in place before March 26. If excavation was complete on March 25, and foundation not poured until March 26, the order halts work.

The attorney commented that this will not be too bad if CPA takes favorable view of project and issues permits for its entire completion, but it will mean delays in reconversion of industry and if permits for all structures are not granted, will tie up funds and men indefinitely. Few industrial construction men, he pointed out, are of experienced type suitable for home construction. Neither are large I-beams and other steel, since most homes are built of wood.

4. Order seemingly exempts pipeline construction without defining it, and restricts construction of pump houses and storage facilities without which the pipeline may be useless. Pipelines presumably include gasoline lines from pump stations to bulk plants.

5. Underground mines and wells, presumably including oil wells, are not classified as prohibited structures, but the order is interpreted as prohibiting the erection of derricks with which to drill wells unless they are structures previously used. However, oil well derricks are not specifically mentioned, and this point needs clarification. Boilers, machine tools and drilling rig machinery are understood to be exempt, but no specific mention is made of drilling rigs and casings.

Industry Comment: Order Called Unrealistic

CLEVELAND — Veterans' Housing Program Order 1, issued yesterday by the Civilian Production Administration, is unrealistic and probably unworkable and will penalize the oil industry without appreciably helping the housing situation. That is a summary of oil industry opinion obtained in a survey by NPN. (See also NPN, March 27, p. 3.)

Independent and major company spokesmen reached by NPN made the following statements:

Joseph Hadley, secretary, Michigan Petroleum Assn.: "It will create a great hardship to Michigan marketers planning for largest tourist season in history. The CPA dollar limit is not sufficient to do any kind of job on stations that have been closed or neglected during the blackout on touring. Many marketers expected coming touring season profits to go far toward future new construction, but with limits on remodeling, this program must be forgotten."

W. A. Parker, secretary, North Carolina Oil Jobbers Assn.: "Already hard-hit North Carolina jobbers, who probably made more sacrifices during the war than men in any other industry, are now faced with doing a half-way job in getting their outlets in shape. CPA's limit means that skimping on remodeling to stay in the limits will mean additional expense when the restrictions are lifted. Not in favor of doing unnecessary work, but marketers should be allowed to do a first class job, regardless of cost."

Clyde G. Morrill, executive secretary, Atlantic Coast Oil Conference, Inc.: "The order overlooks the fact that much material intended for construction in the oil industry is now being processed in mills and factories, is partly fabricated, and could not be used for home construction. It will penalize the small oil companies which have been planning modest construction with a minimum of materials used in home building. It amounts to more government red tape and will tend to promote another black market which CPA cannot police effectively."

John P. Birmingham, president, Independent Oil Men's Assn. of New England: "It will not have a great effect on the independent jobber, although those who wanted to enter the business will now have to wait. It certainly will halt much new construction that had been planned by petroleum companies in New England, including terminals near Boston contemplated by several of the majors."

A. A. Stambaugh, vice president and general sales manager for Standard Oil Co. (Ohio): "This means a continuation of oil industry's stagnation in building and modernization. It will keep money out of circulation and reduce employment in oil industry's construction branch. Sohio's large expansion program not under way. Has only one partially completed construction job. But company expects to 'go along' with order."

Harry B. Hilts, secretary, Empire State Petroleum Assn., Inc.: "The order

Typical Building Problem

NPN News Bureau

CLEVELAND—Typical of the dilemmas which oil industry has had thrust on it by the sudden and virtual ban placed on building by CPA's order was found in nearby Akron. An old service station has been torn down to make way for a new one. All that remains is the pump island, a shed for a temporary office and a couple of holes in the ground which formerly were covered by the lubritorium and salesroom. It is almost a hazard to drive into the part of the driveway left, although proper safety precautions have been taken. Lubrication and other profitable operations are out of the question.

How much can be done for $1000 to help this dealer? Can he get an authorization to continue with the new building? While these problems are ironed out through governmental red tape, he must watch the business roll by.

is extremely disappointing to small independents who had planned improvements. Furthermore, it brings back government control into everyday life. The $1000 limitation will permit only minor repairs. The order will halt construction of new locations and proposed improvements of marginal locations."

W. H. Butler, president, Home Fuel Oil Co., Passaic, N. J.: "The type of construction primarily needed in our industry, such as piling, 8-in., 10-in., and 12-in. pipes, electric welders, etc., would not ordinarily be used in building G-I homes. The order will just throw men out of work, without cause. I think it will eventually be modified and amended."

G. A. Prim, executive secretary, Illinois Petroleum Marketers Assn.: "Don't see anything extremely bad about housing order. There are too many service stations now. Some closed during the war haven't yet reopened, and if the industry quit building for a while we would be better off.

A. C. Gienapp, executive secretary, Iowa Independent Oil Jobbers' Assn.: "Housing order is bound to affect construction and repair of service stations and bulk plants, but it is too early to estimate results. Jobbers in Iowa had plans for some expansion and number of constructions and repair jobs will be retarded and some men will be thrown out of work they might have had. What we need most, however, are storage tanks, pumps and other equipment, including trucks."

K. C. King, executive secretary, Wisconsin Petroleum Assn.: "Jobbers cannot do much with $1000 in building or repairing bulk plants and stations."

Robert W. Hadlick, executive secretary, Missouri Independent Oil Jobbers' Assn.: "Having just returned from service, I know how ex-service men feel, and something had to be done about homes. Jobbers can do some remodeling and repairing with $1000, but it won't be much."

Refinery Official, who planned to start building a catalytic plant, tank storage and maintenance garage about April 15 on property already graded, stated: "If I have interpreted CPA's plans right in meaning that industry cannot replace equipment worn out through wartime use or make urgently needed expansions to present facilities, this is then a backward step in civilian economics. If we are to continue as employers it is essential that we bring our plants up to standard. I am fully conscious of the housing shortage, but the type of equipment we require will not deprive the housing industry. This appears as though the government has weakened its major premise, and now it is time for industry to fight for elimination of controls."

R. W. McDowell, vice president, Mid Continent Petroleum Corp., Tulsa: "In my opinion the order is going to stop any chance we had of much building or remodeling of service station facilities. The heat is on for home building and my guess is that order will be kept on and they will be tough about enforcing it until they get the job done, tight as building materials are. They seem to figure that service stations do not have to be built or repaired until they fall down."

Independent Kansas Refiner: "Looks like it is going to make it tough to fix up some of these filling stations for returning GI's to operate. We have some fixing-up plans in mind, but this will put a quietus on them—can't even make much of a repair for $1000 and stations closed for some time generally require a lot of fixing. As for building a new one—that's apparently out."

A Small Midcontinent Independent: "You sure can build a lot of refinery for $15,000. Evidently they do not want us to increase our marketing facilities or improve them. If they actually build houses with it instead of fooling around maybe it won't be so bad—if they interpret this thing realistically."

William C. MacTarnahan, president, Petroleum Heat & Power Co., Inc., New York: "The order is another blow at the oil industry. We've gone through trying times due to the inadequacy on storage on the Eastern seaboard, where often storage capacity has been cut to three or four days. There is great need of more storage, and many such projects would cost $200,000 to $300,000. Limit of $15,000 is ridiculous."

Neil Staebler, Staebler-Kempf Oil Co., Ann Arbor, Mich.: "Program will be advantageous to the industry. Will permit a breathing spell to prepare for an orderly instead of a pell-mell building program, which I understand was on the way. It will head off the race for large building projects, and will help independents not in position to join in the race."

Co-op to Seek Approval for $1,000,000 Refinery Project

Special to NPN

KANSAS CITY — New construction that may cost $1,000,000 or more at the Co-operative Refinery Assn. plant at Coffeyville is planned for this year, Howard A. Cowden, president, and head of Consumers Co-operative Assn. says. What the new CPA building restriction order will do to the plans has not yet been determined, he stated, but effort will be made to secure an exception.

Late News on CPA Order

WASHINGTON — CPA Tuesday issued question and answer pamphlet explaining in general terms impact of its building materials order but still left unanswered many specific questions as to effect of order on oil industry construction.

Only two questions and answers dealt specifically with petroleum industry:

Petroleum tank farms and outside evaporating tanks are exempt; installation of gasoline pumps in a building comes under terms of order but only expense of installation, not cost of pumps, need be counted in figuring cost of job.

Most Oil Industry Building Doesn't Clash With Housing

NPN News Bureau

NEW YORK — Construction of refineries, bulk plants and terminals would not interfere substantially with home building, but half the materials used in erecting service stations could conceivably be employed in veterans' housing, in the opinion of a construction executive for one of the major oil companies.

This executive pointed out that the service station itself and its interior structure require material vital also to home construction, but that "almost all of the yard equipment of a service station is non-competitive with housing projects. That includes pumps, tanks, air compressors and lifts.

"Refineries, bulk plants and terminals are in a different classification. It is true the electric wiring for fixtures would also be used in housing, but the fixtures themselves are chiefly the factory type and unsuited to home building. The vapor-proof light globes would not be used in a home.

"Most homes use a BX conduit, while refineries and bulk plants have a rigid conduit. The warehouse steel and corrugated iron employed in erecting the main buildings would not be needed for housing developments."

Cites Dangers in Lead Cut, And CPA Building Order

NPN News Bureau

CHICAGO — If necessary exceptions are not granted, CPA housing order will have very serious effects upon the oil industry and its ability to meet public demand during the next year or two, Dr. Robert E. Wilson, Standard of Indiana, said March 29.

He also said that if tetraethyl lead supply is substantially curtailed, government should consult with industry and establish definite octane limits for regular and premium gasoline to avoid discrimination.

Effect of the housing order, in his opinion, depends entirely upon the reasonableness of government agencies in giving approval to essential refinery, terminal and pump station construction.

"Proposals to base lead allowances on a given company's shipments during some previous shortage period," he said, "is bound to create unfair advantages among different competitors, depending upon many variables in the base period, and help to perpetuate the substantial differences in octane numbers, which have recently developed between different sections of the country."

Available lead should be used in the most efficient manner for the greatest over-all benefit to the public, he added, and if octane numbers are not fixed, some companies and some customers would get more lead than they really need.

Editor's Page

Bureaucrats Now Have to Clarify Building Order; Oil Men Should Demand It Be Done Immediately

THE oil industry seems to have had a few more yards of government red tape wrapped about it the past week by the Civilian Production Administration's order seeking to channel building materials and labor into low priced homes.

The confusion caused by this red tape is heightened by the fact that the bureaucrats did not publish the details of the order until after the order was in effect. With all the loud talk about "democracy" at Washington the administration still likes to operate in high-handed Hitler fashion. These officials do not grant their brother American citizens the privileges of their citizenship under this allegedly free government by consulting these ordinary Americans in advance of making their arbitrary orders effective.

No harm would have been done and the delay would not have been more than the delay now made necessary to get the order clarified, if the proposed text had been published to the country and comment and suggestions invited. True, there would have been a lot of suggestions probably that would have kept the bureaucrats reading way into the nights, but if those bureaucrats are going to do any fair kind of a job they will have a lot of reading to do anyway as well as writing of clarifying explanations.

Lawyers and operating officials in the oil industry differ among themselves as to whether the order is clear or confusing. Such great difference of opinion is evidence enough that the industry is probably in for a long period of alleged "clarification" not only by the authorities at Washington but by the 71 local advisory boards and regional CPA directors each of whom is authorized to make its own individual interpretation.

It would have been a comparatively simple matter for the CPA to have written special paragraphs to its order to cover at least certain key and highly important industries, such as oil whose materials and labor, to say nothing of the probable location of the labor remote from where the largest volume of homes are most needed, are unsuitable to home construction. As it is, oil and other industries will have to resume their trips to local ruling authorities and then go to Washington to get those rulings cleared up, all at a time when every dollar of capital and every hour of an industry's time should be devoted to getting the country back on a full peacetime basis, to say nothing about getting costs down so as to meet the new and even exorbitant increases in labor and other costs if an industry is to stay in a healthy condition.

Since the authors of this home building program have given no consideration evidently to keeping their program from bogging down industry, to keeping it from halting much needed improvements in industry and from handicapping research for new and better methods and products, even products needed for the counrty's military defense, it would seem to be entirely in order for the oil associations to demand of these would-be home builders right now, the necessary clarifying rulings and if they do not get immediate action, that is within a day or two, then take their problems to their congressmen.

READERS' comments and opinions will be much appreciated by Warren C. Platt, NPN's Editor and Publisher, Penton Building, Cleveland 13, Ohio.

Are Left-Wingers and Their Friends in OPA Promoting Navy Fuel Oil Shortage?

THE Texas Railroad Commission will do the country a real service if it turns the Navy's fuel oil shortage problem back to OPA and its faulty price structure, as is indicated by reports from Texas as this is being written. OPA has done nothing but flounder on oil prices to the increasing detriment of the industry and the country. Seemingly this agency pays more attention to the left wing economists and publicists, some of whom never saw an oil field, than to men who know the industry thoroughly. *PM*, that left wing New York paper, owned by one of Chicago's great capitalists and ardent follower of the New Deal, now describes an increase in oil prices as a $150,000,000 "grab". Any additional return to industry is a "grab" in the eyes of the left wingers. Industry's funds, it would appear, are considered inexhaustible.

However, by chance, are these left wingers and their friends and followers in OPA desirous of first creating and then continuing a shortage of fuel oil for Navy and our Merchant Marine, now that Russia, chief promotor of left wing ideas, is rattling the saber?

Co-ops Are Dodging Their Proper Share of Tax Load, No Matter How You Look at It

SOME who advocate that special groups of citizens be exempted from paying their full share of the tax money needed for support of our government steadfastly refrain from giving all the facts regarding their situation when talking to the public.

That was the case of a high farm co-op official before the Senate Petroleum Resources Committee last week. He indulged in the old bromide that the co-ops do not enjoy tax advantages, but that their members pay taxes on their patronage dividends as received. It was but a few weeks ago that the National Tax Equality Assn. of Chicago issued copy of a secret memo sent by a top co-op man to his associates over the country that explodes last week's statement to this Senate Committee. According to our reading of this heretofore secret memo, this high co-op official was much exercised that their members were headed for trouble with the government because many of them were not returning these patronage dividends in their income tax returns.

But regardless of the extent to which co-op members are hiding out some of their income on the government's tax col-

lectors, the statement of this witness gives decidedly the wrong picture. What income tax a farmer may pay on the small number of dollars of patronage dividends returned to him would be only a matter of a few dollars or even a few cents or perhaps, and quite legally, none at all. Whereas the also privately owned businesses that have to compete with these co-ops the last several years paid upward of 80% tax on their net income in addition to taxes on any dividends returned to their owners. This year these competing businesses will pay probably at least 38% of their net income to the government while it is a fair guess that the average farmer can pretty near pay his taxes on his patronage dividends out of what currency he may happen to be carrying in his hip pocket.

But many of these oil co-ops, and this goes for the biggest, are not paying these patronage dividends to their members, but are putting the cash into the general bank account and carrying a patronage dividend suspense account to represent the member's share on their books. When they will pay out these dividends, if ever, remains to be seen. However, perhaps the internal revenue collector might interest himslf in whether these suspense accounts are permitted by the co-op and tax laws and whether they represent unneeded surplus in the business.

But whatever alibi the co-ops offer, the fundamental fact is that our government makes theirs and our existence possible, that it costs money to maintain the government and such expense should be borne as near equally by all citizens as possible. Certainly no one group of citizens should be allowed to renege on contributing to the government cost, and then using that saving to build up businesses in competition with other private citizens who are paying their full share of government and war costs.

Pipeline, Avgas Plant Disposal to Be Subject At Later Hearings of Senate Resources Group

NPN News Bureau

WASHINGTON — Senate Petroleum Resources Committee concluded scheduled phases of its investigation leading to a national oil policy this week, but decided to re-open hearings later for additional comments on disposal of pipelines, aviation gasoline plants, and other surplus facilities.

A. Jacobsen, president of Amerada Petroleum Corp., summed up the industry's testimony with the statement that "the undeclared but effective policy which has evolved in the oil industry" is generally considered satisfactory by representatives of majors and independents alike.

He offered opinion that the American oil industry "will be best enabled to continue to contribute its fullest share to our future national security, prosperity, and well-being" if recommendations of PIWC for national oil policy—announced last October—were adopted.

Hearings this week were devoted to Mr. Jacobsen's summary, and his off-the-cuff remarks on Anglo-American oil treaty; complaint by E. M. Callis, Petrol Corp. president, that majors were "squeezing" independents by use of superior financial resources; defense of farm co-ops by F. R. Olmsted, general counsel for Consumers Cooperative Assn., Kansas City, Mo., and presentation of figures on independent petroleum companies by W. H. Englund, chief economist for Federal Trade Commission.

Mr. Jacobsen branded as "thoroughly unwarranted" claims that the Anglo-American oil treaty would permit government to invade powers of the states, flood U. S. with foreign oil, encourage cartels, or hurt domestic producers. He said he knew no one in industry who would want treaty if it produced these legal effects, as its opponents claim.

"It was the understanding, intent, and purpose of all the negotiators," Mr. Jacobsen said, "that nothing in the treaty should enlarge the federal government's rights in production or conservation of oil at the expense of the individual states."

Inclusion of a specific provision setting forth that nothing in agreement shall be construed to enlarge government's powers over oil would be helpful, he admitted.

Mr. Callis told committee that competitive relationship of small, independent, non-integrated oil companies to large, major, integrated ones "will, if not changed, preclude the survival of these small non-integrated independent companies."

He said this trend was evidenced before the war, accelerated during the war, and has continued since V-J Day. Unless drastic measures are taken to curb it, Mr. Callis said, the problems which will confront independent, non-integrated companies "will be so myriad as to completely engulf such companies."

The Petrol president proposed segregation of earnings and separation of marketing operations from others; opportunity for independents to use common carrier pipelines on reasonable tenders and tariffs; equal representation of majors and independents on any future government-industry oil committees with either "impartial public member" or Justice Department representative included; and amendment of ship sales law to provide for leasing of tankers to small business.

Mr. Olmsted said farm co-ops entered oil business solely to supply own needs and became integrated to obtain supplies for their farmer-customers. He denied co-ops possessed any tax advantages, pointing out that while co-ops did not pay taxes on their surplus individual members' paid taxes on this money distributed in form of patronage refunds.

He observed that co-ops were prohibited from doing more than 50% of their business with non-members, were required to keep record of sales to members and non-members, sold at same market price as other dealers, and used all their crude and products in their own operations except for such exchanges as were absolutely necessary.

"The oil industry is not confronted with any problem so far as the farm co-ops are concerned," Mr. Olmsted commented.

Mr. Englund asserted that major companies' control of cheap transportation, extensive marketing organization and possession of great wealth made the position of many independents in all branches of the oil industry "precarious."

However, Mr. Englund pointed out that numerous companies which were referred to as independents 15 or 20 years ago usually are referred to today as majors. Pure, Sun, Gulf, and Texaco were cited as examples, but no conclusions were drawn.

Textile Shortage Threatens To Wipe Out Tire Output Gains

NPN News Bureau

NEW YORK—The Rubber Manufacturers Assn. this week warned that textile shortages seriously threatened to wipe out the tire industry's production gains for the first quarter of 1946. This would carry further into next year the day when civilian tires will again be available in normal supply.

The association heavily underscored the gravity of the fabric shortage. Some tire manufacturers are already threatened with curtailment of production for want of fabrics, a statement from the Rubber Manufacturers Assn. said. Others, with only a small portion of the second quarter requirements in tire fabrics assured, foresee shutdowns by May 1, unless supplies of enameling duck, chafers, Osnaburgs and sheetings are materially eased.

With demand estimated in excess of 66 million units, and the automobile industry making heavier inroads into tire output for original equipment supplies, shutdowns resulting from a textile shortage could easily defeat the rubber manufacturers' 1946 goal, the association points out.

The association urges that for at least another season, close attention be paid to wartime tire conservation practices.

Lead Quota for Tetraethyl Cut 2½ tons; Seen as Blow to Smallest Refiners

NPN News Bureau

WASHINGTON — Last-minute decisions on lead allocation order, signed April 2, restored quotas for Ethyl fluid production to quarterly basis, set second-quarter grant at about 10,500 tons and limited ASTM octane count of gasoline to 80, CPA spokesman said.

This official said a use order would be issued at same time as allocation order, restricting users to 27% per month of amount used during last November, December and January. This is a 19% quarterly reduction from first three months of 1946 (when 13,000 tons were allotted for Ethyl fluid) and will bring about a decrease in production of premium gasoline.

Small refineries without catalytic cracking processes, which cut down use of lead in premium gasoline production, will be hit hardest.

Under terms of new orders, CPA revealed that permission will be granted to reduce inventories of lead from 45 to 30 days. An official in CPA's Chemical Division explained that this would not permit any increase in second quarter allocation for tetraethyl fluid but would allow Ethyl Corp. to use lead from its stockpile if it cannot get it on present tight lead market.

Before revision of lead order, it had been planned to put allocations for Ethyl fluid production on month-to-month basis, setting 3500 tons for April.

Small Amount of Lead from U. S. Stockpile Would Cut Hardships to Motorists, Industry

NPN News Bureau

NEW YORK—If about one-half of 1% additional of the U. S. lead demand were allocated to the petroleum industry in the form of tetraethyl lead, it would help prevent penalizing millions of motor car operators and would avoid working a severe hardship on the petroleum industry.

Some lead interests suggest that the small lead demands of the oil industry for tetraethyl could be met, at least temporarily, by dipping into the government stockpile, currently estimated at 40,000 tons.

Import Policy Hurts

Another contributing factor to the lead shortage, though not as important as OPA price policies, is a State Department agreement with Britain that the United States will confine its lead purchases to the Western Hemisphere and leave the rest of the world open to the British. Result has been that imports to this country have come almost entirely from Mexico, with driblets from Canada and Peru.

U. S. lead consumption is still near its wartime rate of 1,000,000 tons a year, and it is expected to continue near that peak. Yet domestic lead production in 1945 was only 385,000 tons, against 648,000 in 1929 and 496,000 in 1942. Obviously the demand must be made up from imports and by recovery from scrap metal.

Scrap production should average from 300,000 to 350,000 tons yearly, leaving 250,000 tons needed from imports if American mines do not increase their production.

Ethyl Gasoline Corp. declares that an increase of scrap collection and recovery is the most likely source of an increase in supplies. But this is hampered by price ceilings.

A survey made by Ethyl states "either a price which is sufficiently attractive or a determined effort, may bring scrap out of hiding, and it is quite possible that supplies substantially above the CPA estimates could be obtained from this source."

The scrap supply of lead is admittedly large, but dealers are sitting on their inventories and waiting for an increase in ceiling from the present 6.5c per lb. It is believed that a small increase would bring plenty of scrap out on the market.

Meanwhile the production of new lead is hindered by strikes and low price ceiling. Executives in the petroleum and the metals industries are agreed that the current price of 6.5c per lb. is far too low under existing conditions. For the first time in history, with one exception in 1937-38, lead is selling abroad at a higher price than in the United States. Australian producers are selling to Europe at 8c per lb.

When the war started in December, 1941, pig lead prices were 5.85c, or below the 1937 average of 6.01c. The slight increase granted since Pearl Harbor has been insufficient to compensate for higher costs of labor and materials.

Lead producers are seeking either the total elimination of price control or a rise in the ceiling to 8.5c or 9c per lb.

Further hinderance to supplementing U. S. lead supplies is the decay of foreign production brought about by the war. Little of Europe's prewar output of 500,000 tons a year is expected in 1946; Burma is almost completely out of the picture; and Canada and Australia are expected to produce only 60% of their normal level this year.

Western Petroleum Refiners Assn. passed a resolution at its convention in Fort Worth last week asking Washington agencies to make a lead allocation which will allow refiners a normal supply of tetraethyl lead, calling upon Congress to investigate the procurement and allocation of metallic lead, urging OPA to grant incentive price increases to boost the lead supply.

See p. 12

Cutback in Lead Seen as Move To Retain Oil Price Control

NPN News Bureau

CHICAGO — The oil industry in the Midwest is suspicious of motives behind the CPA cutback in lead allocation for premium gasoline for April. They charge it appears as a maneuver by government agencies to create another shortage product in addition to fuel oil in order for OPA to retain price controls on petroleum.

Russell S. Williams of Indianapolis, president of Individually Branded Petroleum Assn. of America, last week protested any cutback in lead allocation which would seriously affect small refiners and others without catalytic cracking unit.

Glenn Primm, executive secretary, Illinois Petroleum Marketers Assn., declared: "A cutback in premium is not so good. It shouldn't happen. We had that during the war and don't want it again. Maybe the shortage of lead is another move by the bureaucrats to create a shortage of premium gasoline so they can keep price controls. The shortage of fuel oil was caused by low price ceilings."

A Midwest refinery official stated that it was his belief that the lead shortage was greatly over-rated and if present policy of government continues, it may lead to gasoline shortage and degrading of fuel, bringing a suppressing effect on the U. S. transportation system.

File Bill in Price Suit

NPN News Bureau

CHICAGO — OPA investigators have finished checking Standard of Indiana records for alleged price violations, according to David Dockman, Region 6 enforcement attorney, and final bill of particulars filed in Federal District Court at Hammond, Ind., totals $132,721.19, on which treble damages is sought. The amount is far short of the "millions of dollars" that OPA declared "may be" involved when the original suit was filed Mar. 8, 1945.

Asks Big Inch Permit

WASHINGTON—FPC has received application from a newly organized firm, Big Inch, Inc. of Wilmington, Del., to operate Big Inch pipeline for natural gas transmission if pipeline can be purchased for $40,000,000 from War Assets Corp. Application says firm is headed by Charles H. Smith, Public Utility Engineer and former Chairman of The General Waterworks and Electric Co., who also has made bid for Little Big Inch to transport petroleum products.

WASHINGTON—By Herbert Yocom

White House to Decide on New Central Oil Agency to Replace PAW

WASHINGTON — There's a showdown due at the White House soon on the matter of either prolonging the life of PAW indefinitely beyond April 30 or creating a new agency to serve in its stead.

Mr. Yocom

CPA Administrator Small, the OPA and Stabilization Director Bowles, supported behind the scenes by the military, have jointly raised the issue and the final decision will have to be made by President Truman. The outlook favors the complete liquidation of PAW on the date recommended by Deputy PAW Davies —presumably he has the support of Administrator Krug in this—but the probability also is strong that the President will see fit to authorize some sort of substitute organization to assure centralized direction of all government petroleum matters.

So far as Deputy Davies personally is concerned, he can be counted upon to resist to the utmost the effort to continue PAW beyond April 30. He has stated repeatedly that PAW, being strictly a war agency, would be wound up when its war job was completed. He regards that job as now done and intends keeping his promise to the industry.

With respect to the Davies' stand on the other side of the picture, that is a little different, for he believes sincerely that there should be some one place in government where petroleum problems can de dealt with intelligently and some semblance of order and cohesion achieved.

That being the case, Mr. Small et al undoubtedly will find him standing four-square with them in support of the idea of setting up a new oil agency or some form of substitute for PAW. Whether oil men like it or not—this idea of such a peacetime agency, regardless of whether it be permanent or function only temporarily—they should take some consolation from the fact that whatever finally emerges from the White House, if anything, will be much the better by reason of Ralph Davies' experienced hand having had something to do with the shaping of it.

° ° °

Those who have been proposing continuation of PAW have suggested, among other things, that PAW reconstitute its Refining Division for the purpose of (1) controlling motor fuel specifications, in view of the lead situation, and (2) again ordering refiners what products to make and in what proportions, particularly with the idea of forcing increased production of Navy Special fuel oil and Bunker C.

Deputy PAW Davies is understood to have put his foot down flatly and emphatically, stating that he would have none of it that he foresaw only endless trouble, including countless law suits, if government tried to do these things. As a result, don't be too surprised if CPA tries on its own to invoke some of the provisions of the Second War Powers Act to compel changes in refinery yields.

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Inasmuch as this seems to be "Davies Day" in this corner, here are a couple of predictions, both of which concern that estimable gentleman, to stick in your hat:

1. That Ralph Davies will choose to get a number of things off his chest in a big way when he appears before the House Oil Subcommittee April 15 or 16; that he will, for instance, outline in specific terms his views as to the form any permanent government oil set-up should take, be more than a little critical of the industry for its refusal to agree to a postwar industry council patterned along the lines of PIWC, and strike out energetically at those who are opposing the Anglo-American Oil Treaty.

2. That he will return to California Standard as soon after April 30 as time will allow, promptly ascertain the lay of the land—it's been plain to many that he's none too happy over present appearances—and then, if what he finds isn't to his liking, will immediately be heard from in various and sundry quarters.

As was suggested above, stick these predictions in your hat, then sit back and wait for the fur to start flying.

ATLANTIC COAST—By Frank P. S. Glassey

Oil Companies Leave Airport Chain Operations to Others in Field

NEW YORK — Major oil companies are still keenly interested in new outlets for their products but to date they have failed to enter the postwar civilian aviation field as had been predicted only a couple of years ago. Operation of national chains of airports for private flying, similar to automobile service stations, was one of the aims freely discussed during the war. It has not materialized and most major companies seem to believe that there is no valid reason to operate airports or even to finance them in the same manner that they finance roadside service stations.

Mr. Glassey

Principal reason for this attitude is the fact that only about 12% of airport operation revenue comes from the sale of oil company products, as contrasted with 95% in the ordinary service station. The oil companies therefore contend that financial assistance to operators of small airports should come primarily from hangar manufacturers, aircraft accessory suppliers and other businesses which will have a greater opportunity to benefit directly.

The oil companies, however, are definitely interested in the development of private aviation, although they are looking first to airline business, where a single transcontinental line consumes as much as 60 to 90 thousand gallons of avgas daily.

Right now, so far as private flying is concerned, the majors appear interested chiefly in furnishing service and supplying tanks, pumps, fuel and lubricants to operators. The service angle is particularly stressed in plans for the immediate future. It represents virgin territory, so far as personal airplane operation is concerned. Most airports still do not supply such a simple service as windshield-wiping, nor do they guard against water seepage in underground fuel tanks, check tire pressure, supply adequate accessories or furnish clean restrooms.

Texaco has made some strides in such service through providing pilots with log books. The company is now planning a special aerial-map service which will cover all 48 states in which it operates.

Shell has recently published a booklet entitled "Civilian Wings for Everyone" which contains complete information on steps required to obtain an Airman Certificate. Shell will continue to assist in stimulating air port development. More than 600 cities and towns have already used its 1945 brochure, "The Airport—Its Importance to Your Community."

Standard Oil Co. of New Jersey also has published an excellent airport plan-

ning brochure, "Community Airports and Airparks." This company distributes flight calculators, cross-country memo cards and other material of benefit to pilots. It is considering certain educational and promotional projects for airport operators, including training films and brochures designed to encourage sound business practices.

Gulf Oil has made no recent announcement of its aviation plans, although several months ago the North American Airport Corp., financed by Gulf, obtained the concession to operate the Westchester County Airport at nearby White Plains, N. Y. Hangar and administration building construction will start there shortly. Gulf also has a lease on the seaplane ramp at Wall Street but has not announced any immediate plans for its operation.

* * *

With all the current preoccupation with Middle Eastern oil, Latin America is still not being neglected by major companies. J. H. Loudon, president of the Caribbean Petroleum Co., has just announced that the Royal-Dutch Shell group of companies operating in Venezuela contemplate capital expenditure this year equivalent to $45,000,000. This is exclusive of current operating expenditures.

Mr. Loudon said the Shell Group plans to increase its development of Western Venezuela and will construct 400 houses at the new refinery at Punta Cardon, Paraguana. Strings being operated in Western Venezuela will be increased from 14 to 21.

Exploration drilling in Eastern Venezuela, where the Shell Group holds concessions, is expected to be started during the second half of this year. A new camp is now bing built between Puerto La Cruz and Barcelona, and the company will erect 39 houses as headquarters for workers. Mr. Loudon said that crude production of the Shell Group in Venezuela is currently running at around 255,000 b/d.

MIDWEST—By Earl Lamm

War Agencies Fight for Life by Manipulating Prices, Supplies

CHICAGO — From all sides comes evidence of the high false bottom to which business has been elevated by government manipulation of prices and supply. It reverses and defeats the purpose for which government agencies were authorized—to keep business on a sound foundation and prevent a boom and bust.

Mr. Lamm

Since organization of the war agencies, most of the top men have spent more time fighting for more power (and are now opposing disbandment) than they have spent attending to their proper jobs. Few of them are willing voluntarily to accept the inevitable agency demise. Statements to the contrary are disbelieved because of so much evidence otherwise. Some of it, clipped from current news, is this:

1. OPA has reversed its "tentative" decision to suspend all poultry price ceilings for 60 days.

2. OPA Chief Porter told Chicago audience two weeks ago that prices would rise sharply if OPA passes out.

3. Last Friday, Porter "warned" a Congressional committee of inflation if OPA is killed.

4. Chester Bowles, economic stabilizer, has frequently made inflation preachments, too numerous to list.

Fear more than anything else creates inflation or depression. Freedom from fear was one of the objectives in fighting the war. But fear certainly has been created by the loud conversation of government agency men, and the subsequent publicity, which this department is thoroughly convinced is being put out for that definite purpose. It is causing people to vote in public polls for continuance of OPA when the question is put to them in some unbalanced manner.

For a short time last fall the fear was of a depression, but the War Powers Acts do not freely give the war agencies authority to put floors under prices. To maintain their existance, the depression talk had to be killed. It was not difficult. All that was necessary was encouragement of radical labor leaders in demands for continuance of extravagant wartime take home pay. Prices can not go down with wages high. The Labor Department, OPA and other agencies know that.

Once the inflation ball was rolling again, removed price ceilings on citrus fruit were slapped back on; OPA repeatedly demands authority to place ceilings on present homes; the cry arose for veteran's homes, and now OPA has again asked Congress for business rent control.

* * *

Perry Stern, vice president, Fruit Auction Sales Co., which handles a large, or majority, share in the big Chicago market of citrus fruit shipments of California Fruit Growers Exchange and other growers in Florida and elsewhere, told us Saturday that a large segment of that industry believes OPA deliberately threw a wrench into the works by removing price ceilings Nov. 19, 1945, and putting them back on Jan. 3, 1946. In between those dates are three big holidays—Thanksgiving, Christmas and New Year—when all through history, fruit prices advanced sharply because of big flash demand. Then when prices were ready to go down in the post-holiday slump, OPA ceilings were slapped back on.

At best, Mr. Stern said, the OPA action was poor judgment; but it did prove to OPA's satisfaction that ceilings are necessary. The test definitely was not a fair one, but gave OPA something to boast about. It is mentioned here because OPA apparently hopes to do the same thing to the oil industry. OPA has proved already that a shortage of fuel oil brought higher prices, and there is no doubt but that the usual spring and summer demand will bring stiffening of gasoline prices at the refinery. If they reach near-ceiling, this department believes there will be no decontrol of oil prices unless Congress does it.

* * *

It may appear from this that we think only evil of government. That is not so. We feel badly only toward those who would bring evil to it, whether by ignorance, incompetence, conceit, or deliberate lust for power. We have not advocated complete removal of all controls quickly, but it was stated in this column Feb. 20 that there are excellent arguments why killing all controls would permit a quick adjustment (from the present false bottom) to normal with minimum inflation. Had that been done, the CPA housing order might not have been necessary. The new lease on life it gives bureaucracy has a strong smell if reports are true that Henry J. Kaiser, West Coast industrialist, owes RFC $103,000,000 out of RFC total business loans of $286,653,000, and material is to be channeled to Kaiser for prefabricated homes to the detriment of small business.

Government spokesmen shouting inflation from the housetops have contributed immeasurably to the inflation trend, and only expressions by Congress, through reduction of authority, will stop it. CPA, OPA and other agencies can not be expected voluntarily to let the national situation ease back to normal. Their current arguments about oil supply meeting demand being no reason for decontrol shows they are looking for a permanent setup. But their desperate struggle to retain their seats may cause them to be thrown out bodily on June 30. Black markets in meat and other things are growing rapidly.

If it has to be whole hog or none with the agencies, those southern Democrats and Republicans who want to officially declare the end of the war, cancel all War Power Acts, kill all war agencies and subsidies, balance the national budget, reduce taxes and return to normal peacetime conditions, have something.

WPRA Asks Congress to Investigate Metallic Lead Allotment

Cites Pitfalls of Cut in Supply For Refineries; End of OPA Controls on All Oil Demanded

By V. B. Guthrie, Editor
NPN Technical Section

FORT WORTH—Western Petroleum Refiners Assn., holding its 34th annual convention here last week, passed a resolution warning official Washington of the grave consequences of a reduction in the allotment of lead for tetraethyl fluid and called upon Congress to investigate the methods of procurement and allotment of metallic lead.

The convention also passed a resolution urging complete removal of all government price controls on petroleum and petroleum products.

The lead resolution asked all government agencies concerned with metallic lead to provide the necessary allotment to make available to refiners normal supplies of tetraethyl lead for the second and third quarters of 1946.

Would Mean Lower Quality

Otherwise, the resolution stated, in view of the decrease in lead allocation to the petroleum industry, motor fuel for the remainder of the year may be as low or lower in octane number than during the war. In that event it was pointed out:

"The essential automotive transportation system of the country, having just passed through a period of operation on war-impelled degradation of motor fuels which resulted in the deterioration of automotive equipment, will again face an accelerated rate of vehicle mortality if war-time quality of fuel is again brought down on the public by government fiat."

Also, it was pointed out, it is necessary to produce gasoline of marketable antiknock quality to permit continuous and economic refinery opration in providing the maximum amounts of residual fuel to meet the Navy's current pressing needs.

Hits Small Refiners

The resolution also stated that there exist great differences in the type of refinery equipment in use and that the smaller independent refiners in particular cannot adjust their operations quickly or equitably to a further decrease in the supply of tetraethyl lead and, therefore, a basic minimum supply is necessary to maintain the quality of their product on a competitive basis.

Since the requirements of metallic lead for the manufacture of ethyl fluid is less than 58,000 tons per year—6% of the total national demand—it was stated that a slight increase in the total supply of Ethyl fluid to the oil industry is of greater importance than to bring about a drastic and serious dislocation of the refining industry, as will result if a sufficient supply of lead is not assured. The WPRA resolution urged two steps for relief:

1—A Congressional investigation into the methods of procurement and allocation of metallic lead, to insure that an equitable share is allocated for the manufacture of tetraethyl lead.

2—Incentive increases in the OPA price ceiling on metallic lead, as recommended by the lead industry itself, to bring into balance a better supply and demand relationship for both primary and secondary lead production. "The manufacturers of tetraethyl lead have assured the petroleum industry" it stated, "that it will not be affected by any such price increase, thus making it unnecessary for the petroleum industry to raise its prices for gasoline to the consuming public."

The WPRA resolution was forwarded to Senator O'Mahoney, chairman of the Senate Petroleum Resources Committee; Chester Bowles, Economic Stabilizer; John W. Snyder, Director of the Office of War Reconversion and Mobilization; Paul Porter, Administrator of OPA; and John Small, Civilian Production Administrator.

OPA Creates Deficits

The price control resolution said that further control of the petroleum industry by any government agency is unwarranted because the supply and demand situation within the industry conforms to the standards set up by the government for termination of control. Ending of control will not invite inflationary tendencies and unnecessary price increases, it was brought out.

"The present policies of the OPA with

Shown attending the WPRA meeting are left to right: R. W. McDowell, Tulsa, Mid-Continent Petroleum Corp.; J. W. Warner, Tulsa, Tide Water Associated Oil Co.; and A. F. Reed, El Dorado, Lion Oil Co. (NPN photo)

Four Articles on WPRA

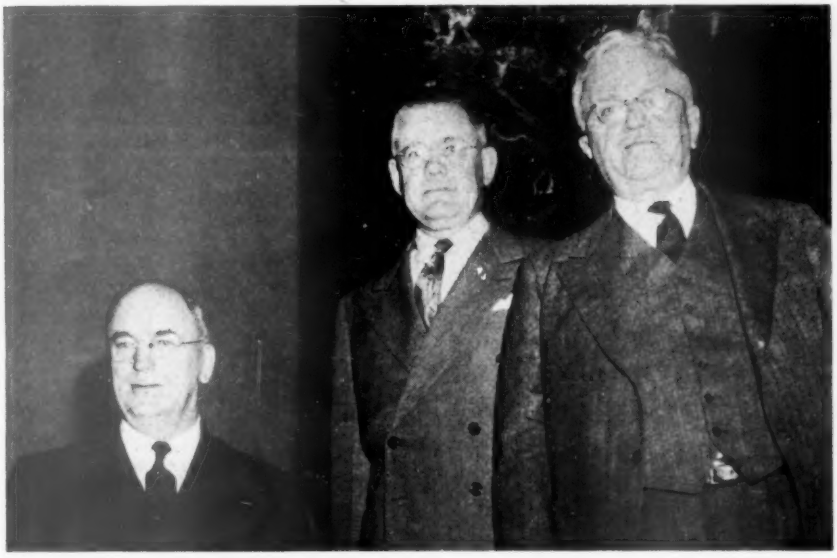
There are four articles in this issue of National Petroleum News on the Western Petroleum Refiners Assn. convention held last week at Fort Worth:

1. Beginning on this page V. B. Guthrie, Editor, NPN Technical Section, writes about resolutions passed by the convention on lead allocation and price control and about the general speeches.

2 On page 14 is a summary of a paper by Ernest O. Thompson, member of the Texas Railroad Commission.

3. On page 19 D. P. Thornton, Jr., Assistant Editor, NPN Technical Section, summarizes papers presented at the WPRA technical session.

4. On page 20 is a list of association officers and a biographical sketch of H. T. Ashton, new president.



Left to right are W. E. Moody, Cushing, Deep Rock Oil Corp.; C. D. Garbrecht, Denver, Bay Petroleum Corp.; and Dr. Walter Miller, Ponca City, Continental Oil Co. and Universal Oil Products Co. attending the WPRA meeting in Fort Worth. (NPN photo)

respect to the petroleum industry create deficits of particular products," it was stated in a resolution adopted by the association March 26. The OPA policies introduce serious problems of the supply of products essential to full industrial recovery, it was said. Also, and particularly from the independent refiners' point of view, they encourage an unsound supply position of higher value products, such as gasoline, so that "currently established gasoline price ceilings are meaningless and are creating a gradual paralysis of an industry which meets every requirement of a surplus capacity industry throughout its entire operation."

Oil Industry Wants Chance

"The petroleum industry asks only for a chance to demonstrate to the American public its ability to meet all requirements for all refined products when the free forces of competition are allowed to determine the price of all petroleum products.

"It is our firm conviction," the resolution concluded, "that such a modus operandi will react definitely to the public's advantage and ultimately to the petroleum industry's future advancement and development."

Reppert Sends Statement

The WPRA resolution was introduced by B. L. Majewski, Deep Rock Oil Corp., and unanimously adopted, after he had read to the meeting a statement from J. H. Reppert, associate director of the OPA Fuel Division. Mr. Reppert had been invited by Mr. Majewski to come to Ft. Worth to present the OPA's case for continued control over oil prices. Being unable to attend he had prepared a statement. In this he said it was hoped that a price suspension program for the oil industry could be worked out prior to June 30, as had been earlier promised by Economic Stabilizer Bowles.

"To a large extent," he said, "our program will reach a successful conclusion when price controls can be dropped without a quick or inflationary rise in prices. I believe we are fast approaching that point with respect to your industry. With the help of industry people generally and our presently appointed industry advisory committees, the next two or three months will be devoted to this price suspension program."

Blames Liquidation of PAW

Director Reppert said he considered the refining industry's present difficulties are due to the immediate liquidation of PAW after V-J Day. "I call your attention," he said, "to the fact the industry performed after V-J Day, with respect to supply and demand, in a manner similar to a ship operating without a rudder. It does not seem reasonable to assume that a constructive industry movement to continue production of gasoline after the war to the extent that the price eventually broke, can be tied to a second industry conclusion that fuel oil prices had to be increased before adequate production would be forthcoming."

Mr. Reppert in his statement urged refiners to fill out promptly the questionnaire being sent out by the OPA National Refiners' Advisory Committee in order that OPA may be informed as to their present operating and earnings position.

"If the return indicates that your current or prospective earnings will fall below the amount earned during 1936 through 1939, then it is OPA's responsibility to establish relatively higher prices that will return earnings comparable to that peacetime base period. If the industry situation is what we assume it to be and what you refiners say it is, then presumably you will be entitled to a price increase that would become the legal limit at which we would suspend price control.

Believes Prices Won't Increase

"For some time it seems reasonable to believe that prices for refined products will not advance generally under a free price economy. They may not in fact go higher than the present prices for the balance of this year. This being true the relatively higher OPA prices that I speak of as the legal limit will provide some flexibility as compared to the present price levels which I believe will insure us that it will not be necessary to reinstate price control due to inflationary trends."

The statement of Director Reppert was the only expression at the WPRA meeting in favor of continuation of oil price controls by OPA. Mr. Majewski, after reading the Reppert statement, made a vigorous talk for entire discontinuance of price controls before introducing his resolution. He urged refiners to contact their Congressmen on the subject.

Others Discuss OPA

C. L. Henderson, Vickers Petroleum Co., retiring president of the association, noted in his address that there is no longer a shortage of crude oil and its products and commended the Texas Railroad Commission for its recent cut in the Texas crude allowable production for March.

"Since price control in oil was based on the theory of preventing inflation in prices of scarce commodities, price control on crude and refined petroleum should already have been abolished," he stated.

A section of the address of Ernest O. Thompson, member of the Texas Railroad Commission, before the convention was given over to the OPA: "You have kept keen the competition in your industry" it stated, "and I hope that soon your superabundance of gasoline on hand will be the cause of your being freed from further OPA price controls. They should promptly be dropped now on the producing, refining and marketing of oil and all its products. OPA controls are not supportable in any commodity in abundance.

"Your long record of constantly reduced prices for your products is ample assurance against any need for price controls. "If there is anything we have more of

Pictured by NPN's photographer at WPRA meeting are left to right: M. D. Gilchrist, Chicago, Universal Oil Products Co.; Frank H. Dunn, Tulsa, Wilcox Oil & Gas Co.; George R. Kinter, Tulsa, Tide Water Associated Oil Co.

right now than gasoline I don't know what it is. Gasoline is running out of our refiners' ears all over the country. I hear there have even been soft spots in gasoline prices here and there over the land.

"That alone should be a complete answer to the OPA's expressed fear that they might have to hang on to you to protect the public. My thought is that it is you who need the protection. There are no price floors in your business, only ceilings and basements. It looks like 105,000,000 bbls. of gasoline is a pretty big stockpile even for spring."

8 Million Items Under OPA

Loss of liberty and freedom of action of businessmen is certain if OPA controls are continued, R. R. Wason, president of the National Assn. of Manufacturers, told the WPRA convention March 26 in a talk, "Manufacturing Problems Created by Government and Labor in Recent Years." There are 8,000,000 items under OPA control, he stated. To supervise their prices fairly OPA would have to know the costs of production and distribution for each item, he said. "The war is not over for the economic dictators at Washington" he added.

In his address as retiring president Mr. Henderson brought attention to the problems facing the independent refiners in the postwar conversion era. Increased unit costs will result from the fact that refining operations must be carried on at rates lower than the all-time peak reached during the war. Another factor adding to current costs, he said, was that increase in output per man hour is far from a reality despite the higher wage rates being paid.

"The resurgence of the domestic market since the close of the war is in itself sufficient to tax our strength to the utmost, but in addition we have international problems presented by the normal processes of foreign trade and aggravated by the activities of foreign governments."

Tax Revenue to Stay High

Tax prospects and the public debt were discussed by two speakers separately. At the March 26 session, Robert Ash, Washington counsel for Prentice-Hall, Inc., told the WPRA that no reductions in the total tax revenue could be expected with the public debt approaching $300 billions. If tax rates are reduced it will be for the purpose of encouraging new business which will then be taxed. Possible tax proposals when business conditions become normal in from three to five years, the speaker said, might include: (1) reduction in individual tax rates; (2) elimination of so-called double taxation on corporate dividends, when the corporation pays on its earnings and the stockholder pays on the same earnings in the form of dividends; (3) accelerating the depreciation rate on new plants as, for example, depreciating half the cost of the plant in the first quarter of its life, to encourage new building, and (4) changing the provisions for capital gains and losses by extending the holding period in which assets must be considered capital stock gains.

"How Good is Debt" was the subject of an address by W. J. Brons, editorial writer for the Chicago Journal of Commerce, at the March 27th WPRA session. There is no longer any determination on the part of the administration in Washington to fight inflation at its source, the debasement of the currency caused by chronic deficit financing, he said. A return to political sanity in public financing, he said, would call for cutting government spending to the bone and restoring public taxes to the point the debt could be serviced and retired.

Oil in the Pacific

A. J. Pettigrove, Stanolind Oil & Gas Co., Tulsa, who was the member of a technical mission to Japan and the Pacific, told of the part which lack of oil supplies played in Japan's defeat.

The WPRA Diesel Fuel Committee arranged for a joint meeting at Chicago April 10 with representatives of Diesel engine manufacturers and the U. S. Bureau of Mines to formulate a cooperative program for research on Diesel fuels.

Entertainment features at the Fort Worth convention included an informal buffet supper March 25 given by the Ethyl Corp.; dinner and spring roundup party the following evening given by the supply and transportation companies serving the refining industry, and the Association's dinner dance March 27.

Plan Operations to Use Natural Gas Products Or Suffer Profit Loss, Thompson Warns WPRA

By NPN Staff Writer

FORT WORTH — Refiners of the country must plan to utilize the lighter liquid hydrocarbons recovered from natural gas—natural gasoline, condensate, propane and the butanes—in their processing arrangements, because these materials are going to be made more abundant by rigid conservation practices in Texas and other states, the WPRA was told at its Fort Worth convention in a paper prepared by Ernest O. Thompson, member of the Railroad Commission of Texas. In Commissioner Thompson's enforced absence in Washington, his paper was read before the March 26th session by Ira Butler, Fort Worth attorney.

"Unless refiners realize that the production of these light hydrocarbons is to be a really major factor in the industry and unless they plan their operations to utilize these materials to advantage, will suffer loss in the delay in realizing the profits that can come from converting these light hydrocarbons to maximum value," he stated. Loss also will be suffered by the producers of the light hydrocarbons, "since they will not receive prices comparable with the true value of the materials they are producing." Attention was called to the success of the Phillips Petroleum Co. in handling these light materials as charging stocks.

In general, the paper brings out, crudes and charging stocks to refineries gain progressively in value with increasing API gravity, at least up to 60° API gravity, when refinery operations are properly laid out to handle them. Studies made by the commission on sweet crudes and combined charging stocks ranging from 35 to 36 up to gravities of 60 API or better indicate that, with proper processing, the value of the charge stock

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Shown at the Western Petroleum Refiners Assn. meeting at Fort Worth are (left to right): Edward P. Fitz, Dallas, Atlantic Refining Co.; Freeman W. Burford, Dallas, independent producer; L. P. Calkins, Bartlesville, Phillips Petroleum Co.; J. E. Messler, St. Louis, independent producer; and Leo J. Wilmeth, Amarillo, Shamrock Oil & Gas Corp. (NPN photo)

to the refiner increases about 2c a barrel for each degree increase in API gravity, which is the usual differential in posted prices for crude up to 40 API.

"However," the paper brings out, "all calculations from our studies also indicate that the same ratio of increase in value continues on beyond 40 and that a properly designed refinery can actually realize close to 40c more profit out of refining a barrel of 60° charge stock than could be realized out of refining a barrel of 40° charge stock. This holds true, of course, only if the process design of the refinery is proper for the purpose."

Three Classes of Products

The lighter products now being called to refiners' attention fall naturally into three classes, the paper states: condensates, natural gasoline and propane and butanes.

In refinery utilization of light condensates no particular changes in refinery processing are required. The yield of straight-run light naphthas is much greater, in proportion to the charge, than with heavier crudes without the inclusion of the condensates, and the proportionate capacity of facilities for upgrading the light naphthas to meet motor gasoline octane standards must be greater.

The usual provision for upgrading the straight-run gasoline or naphthas will continue to be thermal reforming and catalytic reforming will be used to an increasing extent, the paper brings out. As a by-product of reforming there is a large yield of unsaturated hydrocarbons, principally olefins: propylene, butylenes and amylene. Propylene and butylenes, being too light for the gasoline boiling range, are advantageously and economically converted into high grade motor gasoline by catalytic polymerization.

Where a large supply of isobutane is readily available in the refinery it can be economically alkylated with an olefin for the production of a valuable motor gasoline constituent. Since the expansion of absorption plant and recycling facilities will lead to greatly increased total production of isobutane, it seems probable, the paper points out, that alkylation may be more widely used.

"Alkylate has the definite advantage as a motor gasoline constituent of a low vapor pressure combined with high octane rating and excellent lead susceptibility," it is stated. "The use of alkylate makes it possible to include in the finished gasoline a greater proportion of light constituents, and thus improve the over-all economics of the finished blend."

Uses of Natural Gasoline

Up to the present time, the paper brings out, natural gasoline has been used in motor gasoline almost entirely as a blending agent, for control of vapor pressure and distillation range. The increasing production of natural gasoline, however, will make available far greater quantities than can be so used and other means must be found for converting it into a final marketable product. On this point the paper goes on:

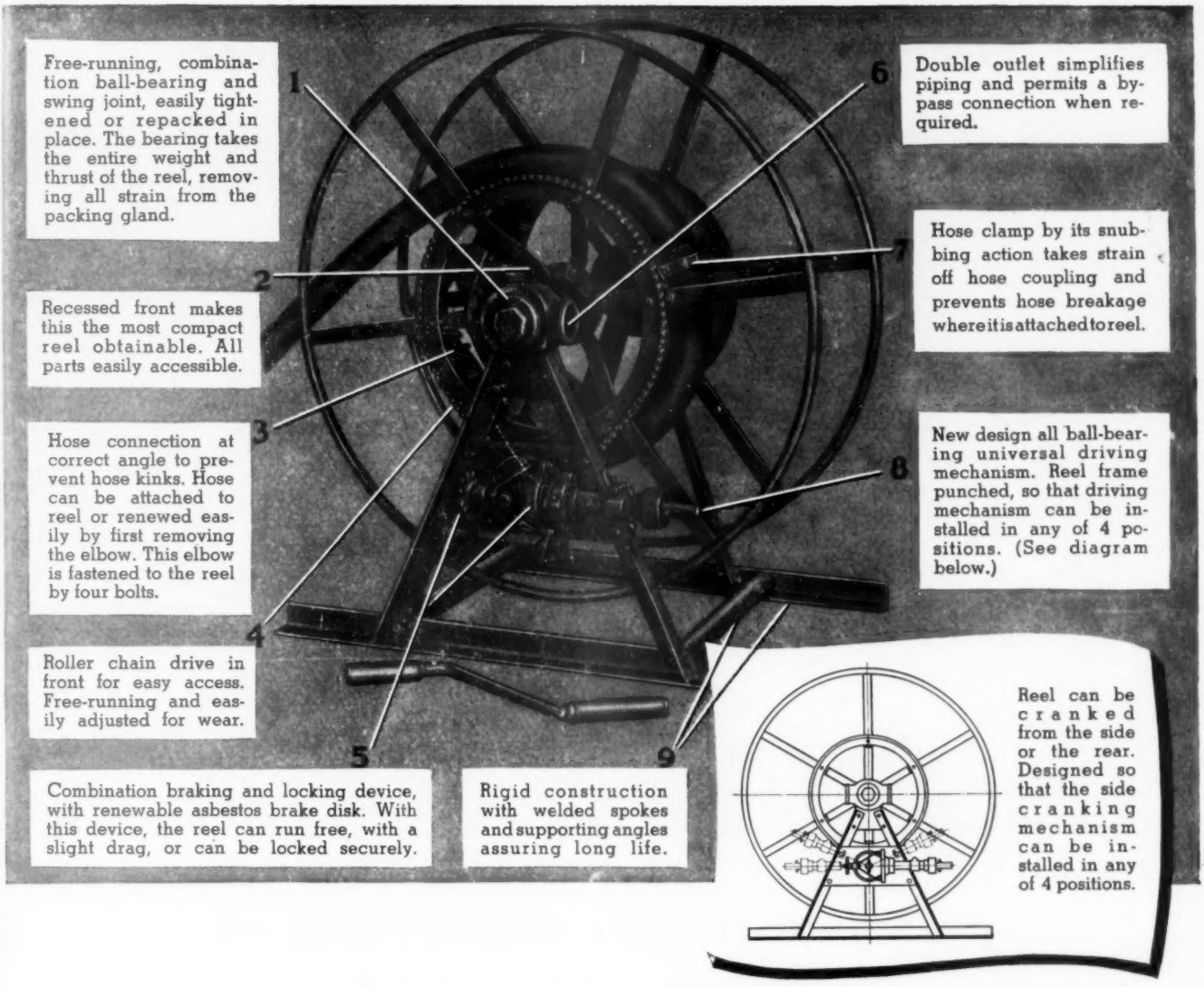
"Essentially, the utilization of this natural gasoline falls into two categories: first, the handling of the light end or butane fractions and second, the utilization of the heavier part of the natural gasoline, which is still too light to be used directly for motor gasoline. Of this heavier portion, the isopentane cut, together with the isopentane from crude or condensate and the isopentane resulting from catalytic cracking operations, should be separately recovered for inclusion as such in the finished blends, since isopentane is a high octane constituent of excellent vapor pressure characteristics.

"The fraction above isopentane is normally of fairly low octane rating. This fraction may be combined with the light naphtha from crude or condensate distillation and reformed with it as discussed above. Alternatively, the lighter part of this fraction, consisting of pentane, hexanes and some heptane, may be upgraded by isomerization. Normal hexane and normal heptane are extremely poor constituents from the anti-knock standpoint; in fact, normal heptane is the standard zero on the scale of octane ratings.

"By isomerization these low octane constituents can be converted into high octane isocompounds, which are very desirable constituents of motor gasoline. Processes for this isomerization are well developed; Standard of Indiana's 'isomate' process was ready for application for this purpose some years ago and other companies are working toward the same end. I believe that isomerization processes of this class afford the best opportunity, of the presently known processes, for gaining maximum value out of natural gasoline."

Propane and Butanes

The propanes and butanes that will be produced in large quantities along with the natural gasoline present both an opportunity and problem to refiners, the paper brings out. A large quantity of both will be used directly as liquefied petroleum gas for domestic and industrial purposes, the tendency being toward using increasing proportions of propane. Propane is also being used in great quantity as a standby supply for natural gas pipelines. Smaller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volumes, along with some butane and ethane, will be consumed as chemical raw materials.

Normal butane will also be used as such to the maximum extent for blending into finished motor gasolines. It is better than isobutanes for this purpose because it has a somewhat lower vapor pressure.

"Beyond this utilization," the paper continues, "normal butane presents the most difficult problem in the entire light hydrocarbon picture. Of processes currently available, isomerization into isobutane affords an outlet in cases where the supply of olefins available for alkylation exceeds the available isobutane supply. Where this is not true it is possible that butane might be economically converted to motor gasoline through catalytic dehydrogenation or thermal cracking, followed by alkylation.

"I am not sufficiently familiar with the economics of this processing combination to say whether or not it would prove profitable to refiners," Commissioner Thompson concludes on the subject of the increasing utilization of light hydrocarbons. "I am confident, however, that the refining industry, if they are made to realize what great quantities of normal butane will be available to them, can develop some economical and profitable means for converting this material to motor gasoline value."

Light Ends Must Be Used

The purpose of his paper will be served, Mr. Thompson concluded, if the refiners are informed that a billion cubic feet of natural gas now being flared daily in Texas is forthwith required to be utilized. "This means a very great amount of light hydrocarbons are to be available to you and perhaps less crude."

Taking issue with economists for badly underestimating the demand for petroleum products and stating more and more gasoline will be used the world around while 75,000,000 motor vehicles will be in use in the world before the saturation point is reached, he stated:

"The railroad commission of Texas is determined to do its full duty in stopping flares of casinghead gas. These gases will furnish more and more of your raw material.

"Public opinion and good morale and science will demand that the products of conservation, which these raw materials are and which the greatly enlarged quantity will be, should be used first in making motor fuels and that the crude oil in the reservoir shall be brought forth only in sufficient quantities to make up the difference.

"Either this or full proration of all the base materials shall be the order of the day taking the supply of all into consideration so that there shall be no physical waste or production in excess of market demand."

New Equipment, Improved Operating Practices Stressed in Technical Sessions at WPRA

By D. P. Thornton, Jr.
Assistant Editor,
NPN Technical Section

FORT WORTH—First paper on the WPRA technical session agenda was "Crude Oil Desalting," by F. Duane Fuqua, Ben Franklin Refining Co., Ardmore, Okla. Using relatively conventional equipment ordinarily to be found in any well-equipped refinery, Mr. Fuqua's data demonstrated that with strict attention to operating details it is not difficult consistently to secure more than 90% salt-removal from salty crudes of differing viscosities—at a chemical cost of less than two mills for each barrel of crude processed.

Equipment consists of pumps for injection of treating chemical and metered hot-well wash-water into the crude, an emulsifying valve (gate valve operated in throttling position), a mixing baffle and both a vertical and horizontal separator. Heat for reducing viscosity of the crude is obtained by exchange with processed material and also from cooling water pumped to the hot-well previously mentioned. Pond water is used for washing.

Most important point, repeatedly emphasized by Mr. Fuqua, was to make operators a part of the desalting operation, familiarizing them with all correlations made on the processing, along with necessary explanation to make sure they know just what is being done and the importance of the program. Many times, he commented, unsatisfactory crude desalting is not the fault of equipment or process, but simply faulty operation.

Other points stressed, applying to the Ben Franklin operation, were the maintenance of 40-50 psi drop across emulsifying valves; temperature of 200-220°F. in the vertical separator for desired emulsion-breaking viscosities; adequate and intimate contacting of crude with water (and chemical if used) after crude viscosity has been reduced, and adequate metering of wash-water to maintain a constant fresh water charge for a reasonable brine concentration within the vertical settler. (For the Ben Franklin crude composites, this amounts to 5-15 liquid volume per cent of crude charge.)

Discusses New Cat Cracking Unit

Second paper was that of Davis Read's (Universal Oil Products Co., Chicago) on "The New U.O.P. MS-Fluid Type Catalytic Cracking Unit." Although this has been covered in several previous papers by Mr. Read, he stressed engineering and operating changes from the earlier, larger Fluid units erected during the war stating that the same flexibility in processing naphtha, kerosine, gas oil and topped crude in recycle or once-through operation had been retained in the MS unit.

Among the engineering improvements which make possible the "baby" unit are a higher carbon-burning capacity, attained by increasing regenerator pressure to approximately 10 psi. The higher pressure also gives more than adequate pressure drop across the slide valves for good circulation, thereby permitting a reduction in the overall unit height. Reactor supported by the regenerator eliminates much of the heavy structure formerly required.

Reduction of expansion joints from nine to two minimizes possibility for mechanical difficulties with these fittings; lines also are shortened by the reduction in overall height. Efficiency of regeneration and stripping have been improved by the addition of carefully-designed grid- and distributor-plates. Staging regenerator with grids and countercurrent regeneration air-to-catalyst flow permits establishment of a temperature gradient which vaporizes hydrocarbons remaining on the catalyst at 900°F before catalyst is exposed to 1100°F maximum temperature at the bottom of the regenerator.

With the MS unit, operating costs are 29.3c for a 2000 b/d plant operating once-through at 60% conversion on Mid-Continent crude. With the addition of a fractionator system—stabilizer and absorber to prepare debutanized gasoline and a liquid feed to the polymerization unit, total operating cost increases to about 33c per barrel charge.

Hear About Stainless Steel

John S. Ewing, Carnegie-Illinois Steel Co., Pittsburgh, discussed a new type of stainless steel in his paper "Stainless Steel and Its Application to the Refining Industry," called "Stainless-W." This is a precipitation-hardened magnetic stainless, whose specific gravity, coefficient of expansion and electrical resistivity is similar to other stainless steels.

Of particular advantage is the fact that expansion coefficient is about that of ordinary carbon steel. This will give the new steel particular application in solving some heat-exchanger problems where the differing expansion coefficients of stainless and ordinary carbon steel have caused considerable mechanical complications in the past.

The new steel, which has been used commercially in aircraft during the war, and which fact prevented much experimenting in refining applications, is heat-treated in two steps. Solution annealing is ordinarily done by the mill, but may be done in the field; temperature is 1850°F followed by cooling to ambient temperature of surroundings. Second step is aging and hardening. Steel is reheated to temperatures ranging from 950 to 1050°F, with a quench following. Rate

of reheating is not particularly important, but cooling rate is. Aging determines the mechanical characteristics imparted.

For welding, a flux-coated wire is used for electric-arc welding, with joints readily attained and undistinguishable from unwelded portion of the metal after appropriate heat-treatment. As yet there are problems to be worked out in the atomic hydrogen welding, used in fabrication of tubing.

Applications are as valve and pump rods, where normal 18-8 stainless will not give required hardness. Full advantage of the new steel, speaker concluded, will be in the "cold end" of the refinery rather than for withstanding extremely high temperatures. Performance tests indicate it is comparable to normal 18-8. Cost runs approximately 29c in bar form.

Houdry Unit Explained

The last paper also discussed catalytic cracking—"Simplicity and Flexibility of Thermofor Catalytic Cracking," by K. G. Holdom, Houdry Process Corp., New York—which can be designed for as low as 1000 b/d throughput and will charge naphthas to heavy vacuum gas oils with high yields and high quality products. Other features are low maintenance and operating costs, with simplicity of unit making for long onstream periods.

Only five control points are maintained, speaker said, with four generally all that are necessary. These are the catalyst activity (by addition of fresh catalyst and withdrawal of old), temperatures of oil in reactor and catalyst in regenerator, oil rate charge and rate of catalyst flow. Differential level of catalyst in regenerator and reactor is the fifth.

In the small unit, regenerated catalyst storage hopper, standpipe, and reactor are all one unit; only one elevator is used, and nine section-thermofor kiln is provided. All these factors combine to reduce unit height and necessity for heavy supporting structure. Flows are identical with that of the larger units, except that catalyst and oil flow are concurrent, requiring a disengaging zone at the bottom of the reactor.

In citing operation of a small unit, a basic refinery was assumed by Mr. Holdom, consisting of crude topping, two-coil thermal cracking unit, deep naphtha reforming and catalytic polymerization of unsaturated C_3 and C_4 hydrocarbons. To this was added a TCC unit, utilizing all possible portions of existing refinery equipment.

Case "A" consists then of crude topping, moderate naphtha reforming TCC 1:1 recycle cracking, and overhead from flashed reduced crude with an integral viscosity-breaking circuit for flash-tower bottoms. Case "B" consists of crude topping, mild naphtha reforming, with bottoms from flash tower to vacuum still—total overhead going to TCC as well as from overhead from atmospheric flashing of reduced crude.

Giving Case A 2450 b/d of fresh feed with 1715 b/d of recycle, total operating cost is 27.8c per bbl. fresh feed and 14.2c per bbl. total feed; Case B shows 25.0c per bbl. of fresh feed and 12.5c per bbl. total feed. Payout periods range from 30 months to three years for the different operations, assuming production of 75 oct. housebrand at 6c and 83 oct. premium at 7c with kerosine at 4c.

Cost of the modifications for Case A were determined as $775,000 and $925,000 for Case B. If the vacuum tower and facilities were to be already available as was not the case here, Case B modification would have cost $800,000.

H.T. 'Ash' Ashton Elected WPRA President

H. T. Ashton of St. Louis, general manager of the Lubrite Division, Socony-Vacuum Oil Co., Inc., was elected president of Western Petroleum Refiners Assn. at convention in Fort Worth last week

By NPN Staff Writer

FORT WORTH—H. T. Ashton, general manager Lubrite Division, Socony-Vacuum Oil Co., Inc., St. Louis, is the newly-elected president of Western Petroleum Refiners Assn., meeting here in its 34th annual session. Mr. Ashton has been a director of WPRA for 28 years for many years served as a vice-president and has been continuously active on many committees and other association business. He succeeds C. L. Henderson, Wichita, Kansas, Vickers Petroleum Co., president since 1940.

The other newly-elected officer is T. A. Helling, El Dorado Refining Co., El Dorado, Kansas, as vice-president, succeeding H. E. Zoller, Derby Oil Co., Wichita, who asked not to be considered for re-election.

R. W. McDowell, Mid-Continent Petroleum Corp., Tulsa, was shifted from vice-president to the newly-created office of executive vice-president. The two remaining vice-presidents were re-elected: T. M. Martin, Lion Oil Co., El Dorado, Ark., and R. L. Tollett, Cosden Petroleum Corp., Big Spring, Texas.

Two directors besides Mr. Helling were elected: W. W. Vandeveer, Allied Oil Co., Cleveland, and Roland V. Rodman, Bay Petroleum Co., Denver.

John C. Day was re-elected secretary-treasurer and general manager of WPRA.

Reappointed assistant treasurer was Miss Lucile Dennis.

Paul D. Williams was reappointed technologist for the association.

Interested in Many Activities

The new president brings a wealth of diversified experience and interests to his newest job. Besides his official capacity of general manager of the Lubrite Division, Mr Ashton was recently elected to membership on the International Board and the International Committee of the Young Men's Christian Assn. and is chairman of the World's Service Committee of the Metropolitan Board of YMCA in St. Louis.

Mr. Ashton came to Lubrite in 1922 as vice-president and general manager of the old Lubrite Refining Co. from his former job as general superintendent and assistant sales manager for Pure Oil Co.'s Cushing and Ardmore, Okla., refineries. In 1929 Vacuum Oil Co. bought Lubrite, changing the name to Lubrite Refining Co. with "Ash," as he is called throughout the industry, as president and general manager; later the company organization was changed and Mr. Ashton assumed his present position. It was during that time he became interested in and helped develop the Pratt Vapor Phase Cracking process. Three of the old Pratt stills continue in use at Lubrite, doing as "well as ever."

At his last appearance before the meeting, retiring president C. L. Henderson, who for five war-years directed the association's complex activities, together with his wife was presented a silver tea-set. At the beginning of this year's meetings it was carefully explained to Mr. Henderson that there was nothing in the association's by-laws to prevent his remaining as president for five more years, but he refused to stand for re-election. He returns to his erstwhile "part-time" job as president of Vickers Petroleum Co.

Thinking it through

[No. 3 OF A SERIES]

The Proposition **In Fluid "Cat-Crackers," spent catalyst stripping is essential for optimum earning power.**

The Facts Spent catalyst, when withdrawn from the reactor, contains absorbed and entrained hydrocarbon vapors. Unless these vapors are recovered prior to regeneration of the catalyst, they are lost.

A modern stripping system removes these hydrocarbon vapors associated with the spent catalyst. This action has a twofold effect on the operation of the process. First, through recovering and returning the hydrocarbons to the product stream, it increases overall product output; and second, the recovery saves the additional regenerator capacity that would otherwise be required to burn the entrained and absorbed hydrocarbons.

These facts disclose immediately that the spent catalyst stripper results not only in an enhanced return from the charge stock, but also in both lower initial outlay and lower operating cost.

The Conclusion **There is no substitute for the best design**

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Engineers and Economists to the Petroleum Refining Industry

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Oil Marketers Use Frank (John Q. Public) Bean's Article As 'Shot in the Arm' for Improving Service

Frank Bean's article on station service conditions is finding its way into all branches of station operation. And it is the subject of many sales conferences. Reprints of this story on how the public views station service are being used as a tonic to wake up everyone from management to station helper. Ninth in NPN's series on "Station Service for Profit" this article tells how the many thousands of reprints of this article are being used by oil marketers.

By Frank C. Sturtevant
NPN Staff Writer

Frank A. Bean, of Birmingham, Ala., has become the "John Q. Public" of oil marketing.

NATIONAL PETROLEUM NEWS, having received hundreds of requests totalling tens of thousands of reprints of Mr. Bean's article which appeared in the Feb. 6 issue, asked management men how they planned to use these reprints.

Virtually every answer was that Mr. Bean reported what the average customer sees at a service station. His article is being presented to supervisors, managers, dealers and even helpers as John Q. Public's view of station service and housekeeping.

Though his story necessarily reported many unpleasant truths, management recognizes that Mr. Bean enabled the industry to see itself as others see it. Management is impressing upon those who have a hand in station operation that they cannot continue to get their share of the potential market unless they correct the conditions which Mr. Bean criticized.

Among the many requests for reprints of the Bean story was one division manager of a major oil company who said F. A. Bean represents those "upon whom our dealers must rely for a livelihood." At the same time he called the attention of his dealers to the fact that many of the criticized points which were the admitted responsibility of the company had either been corrected, or were in process of correction.

Reprints of the Bean article were given to all of his sales force, with the request that they "discuss this article with all of our dealers" and that they leave copies wherever they see the possibility of doing some good.

The value of a fresh outside viewpoint was also mentioned by a branch manager in the middle west, who wanted a supply of reprints for his salesmen to carry as a permanent piece of merchandising. Although his men were constantly calling dealers' attention to any bad service station conditions, he wanted the reprints so dealers could understand how other people were affected by them.

In his opinion there was something in the article for every dealer to think about, and he asked his salesmen to read the article, discuss it with dealers, and then report on dealer reactions or suggestions for improvement.

A Michigan jobber said he was passing out reprints to all station employees with the request that they read it. This company, although admitting service at stations had reached an all time low, thought that enforced reduction in gallonage, government interference from OPA and other agencies had caused a discouraging condition from which we have not yet recovered.

Says Management Needed Jolt

This jobber also admitted that quite probably management too needed a jolt, and was waiting for repair materials, new equipment, and an end to government regulation, instead of getting busy right now with training schools, meetings and other measures designed to improve station service.

Even some sales managers who had already started a program of reviving good standards of station service and housekeeping were interested in the customer slant of Mr. Bean's article.

"We have been convinced for a long time," said one, "that station service deteriorated a great deal during the war period, and the subject has been given a lot of attention in our sales meetings and in our daily contacts with field representatives. The Bean article added an outside viewpoint at an opportune time."

Sent to Every Retail Outlet

Enough reprints were requested to cover every retail outlet. These were handed personally to the dealer, by the company representative who insisted that in addition to reading it himself, the dealer pass it on to his employes and they also study it.

An eastern jobber scheduled a series of three evening meetings, one for his own station managers, one for dealers, and one for all station attendants. At each meeting methods of improving station service and housekeeping were advanced and copies of the Bean article were handed out and discussed.

There were many requests for reprints to mail to dealers and field representa-

Provides Stimulant for Postwar Sales Methods

The Service Stations of Today—
What About Those of
Tomorrow?

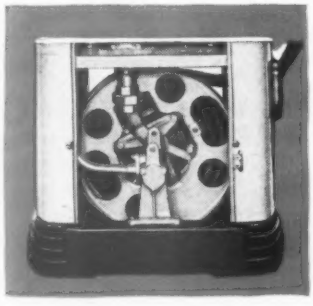
The COMPACT UNIT

Only RED SEAL has it!

● Yes, only the Red Seal Pump has the long-life Compact Unit. It is remarkable in the simplicity of its design and construction. The dependable Red Seal Meter, pump strainers, pressure control, air separator, line check and pressure relief valve are in a single assembly. Noted for long, trouble-free life and ease of maintenance, the Compact Unit saves time and money for you.

But that isn't all Neptune provides to insure you of maximum economy over the years. You also get the benefit of an exclusive Single Unit Replacement Plan whereby, through exchange of your old Red Seal Compact Unit, motor, register, and hose reel you can eliminate expensive servicing and repairing in the field—get pumps back in service faster, save money.

Find out all about the many established advantages of Red Seal Pumps. Phone or write the nearest Neptune office or petroleum equipment jobber for complete details today.



Self-Winding Hose Reel Speeds Service

It's mounted in the pump base. Easy pull, quick return. Hose reels up automatically. Most of it disappears inside; the rest stays flat against the pump—out of reach of car bumpers. It helps speed service, prevent accidents. Ask for full information about the Red Seal Pump with this time-saving feature.

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A-178

tives. While some only wished to send the article without further comment, several made it the basis of a special drive. One distributor from a farm area mailed reprints with a leaflet picturing and describing a few specific ways to clean up a station and raise the standards of service.

It is the intention of this distributor to follow up with other graphic illustrations of the right and wrong way to run a service station. While the pictures cover such obvious things as the right way to test the oil level without dripping oil on the fender, and the difference between an orderly pump island and one littered with junk, they are all points which were criticized in Mr. Bean's article.

Although the story recounted visits to stations in the eastern half of the country, western marketers find it useful, too. A Colorado jobber asked for reprints for each of his retail outlets because he considered the ideas contained in the article were of great benefit to all operators of service stations.

Works in with Regular Program

One of the major oil companies was able to work it right in with a series of letters going to the dealer organization as a followup to its program of raising station standards. Good progress was made in convincing dealers of the advantages they will have over competition by adopting the new program.

A similar plan was followed by a New England marketing division branch according to the sales manager. He mailed copies of the article to dealers, accompanied by a letter from the sales office which tied it in with work being done by field representatives in re-establishing service.

A southern jobber got reprints to use as an enclosure with its house organ, while another shipped reprints to state managers with the suggestion that they redistribute them to field representatives and to dealers.

The secretary of one of the regional jobber associations decided it would be a good thing to send a reprint to each member, even though, as he put it, he "doesn't necessarily go along" with all of Mr. Bean's contentions. He does feel, however, that some of the criticism is all too true, and that the reprints may help to give service station operators "a shot in the arm."

One of the most cheerful comments came from a marketer in the south, who felt that dealers in his area were not guilty of rendering such poor service as described by Mr. Bean, but that a little brushing up program once in a while "does us all good."

HAVE YOU MADE PROFITABLE USE
of the series of articles on
STATION SERVICE FOR PROFIT?

Each week, beginning with the Bean story of February 6, NPN has carried a feature story on some phase of the problem of increasing station profit by improving station service. Many thousands of reprints of these articles have been supplied to hundreds of companies and put to work by them in various ways—see story in this issue.

Reprints of any of the articles in the series, as listed below, may be obtained at the nominal prices shown for various quantities:

Feb. 6—"Service Stations of Today—What About Those of Tomorrow?"
Feb. 13—"Service Station Check Reveals Lack of Cleanliness."
Feb. 20—"More Applicants for Stations Can Improve Service."
Feb. 27—"Station Service and Housekeeping Remedies on the Way."
March 6—"Oil Industry Tackles Reconversion of Dirty Service Stations."
March 13—"Clean-Up Bandwagon is Rolling; There's Profit for Those Who Get on NOW."
March 20—"Veteran's Wide-Awake Clean-Up Program Brings Customers into his Station."
March 27—"Cleanliness and Service Will Be Drawing Card When Nationwide Travel Boom Duplicates Miami's."
This Week—"Oil Marketers Use Frank (John Q. Public) Bean's Article As 'Shot in the Arm' for Improving Service."

Reprints of any of these articles are available to NPN subscribers at the following prices, per copy:

Single copies	Free
Under 100	$.04
100-500	.03½
501-1000	.03
Over 1000	.02½

Orders should be sent as soon as possible to:

Readers' Service Dept.
NATIONAL PETROLEUM NEWS
1213 West 3rd Street
Cleveland 13, Ohio

Plan Enlarged Reporting Staff On Nation's Station Sales

NPN News Bureau

WASHINGTON — More accurate and representative reports on independent gasoline station sales in nation was predicted by Bureau of Census officials who revealed a plan for increasing its field staff so as to make personal contact with retail merchants.

Reporting of monthly sales by station operators will be maintained on voluntary basis, but officials believe enlarged field staff can get better cross-section reports by personal contacts. Present system, which, for example, obtained results from only 761 stations in entire nation on January sales, is to poll retailers by mail.

Census officials said only about 10% of stations receiving queries through mail send in reports. They expect to raise average to about 50% with more field personnel. Stations on mailing list had been selected by census bureau as "representative" of a particular area.

Although present reports list sales only by independent stations and other stores, officials said plan also is being considered to include company-operated service stations and chain stores in future reports.

The 761 stations reporting on January sales listed total receipts of $6,201,286, up 6% from preceding month and 31% from January of 1945.

Rural Group Asks 1c Increase In Illinois Gasoline Tax

Special to NPN

HARRISBURG — An increase of 1c per gallon in present Illinois gasoline tax was urged by Charles Day, representing Illinois Rural Letter Carriers at a 16 county hearing conducted by a state Farm-to-Market Road Committee. The suggested increase is for financing a rural road project outside of Cook County.

Meetings have already been held in four downstate towns by State Farm-to-Market Road Legislative Committee with future meetings scheduled for Mattoon on April 15; Pontiac, April 17 and Geneva, April 18.

WHO

has been a Better Friend of the INDEPENDENT JOBBER and DISTRIBUTOR?

If you are thinking of the future of your business as an independent marketer, it will pay you to take a look at the record of Anderson-Prichard . . . For the past 17 years we have staked the future of *our* business on the "home town" distributor.

We have not been disappointed. We have been one of the few companies which have supplied the independent jobber and yet have not become his competitor. We have cooperated with him during the difficult war period.

Our established policy in distribution will be continued and your inquiry is invited if that policy appeals to you.

AP means to YOU Advantages Postwar

Jobbers may sell under our **Challenge** brand or under their own brand.

ANDERSON-PRICHARD OIL CORPORATION
COL-TEX REFINING COMPANY
PRODUCERS AND REFINERS
GENERAL OFFICES: APCO TOWER, OKLAHOMA CITY, OKLAHOMA
BRANCH SALES OFFICES: MINNEAPOLIS • ROCKFORD • DES MOINES

The Independent Jobber—

A Power on Main Street

Survey Shows Many Interesting Facts

By H. H. Hahn
Executive Secretary
Nebraska Petroleum Marketers Assn.

As "home town citizens" the independent oil jobber has become a leading figure in civic and business affairs. He has made a name for himself as a dependable man whom the community can count on to further its civic efforts.

This record of achievement is not just hearsay—it's down in black and white. A survey of 450 Nebraska oil marketers conducted by H. H. Hahn, executive secretary of the Nebraska Petroleum Marketers and published in the March issue of the *Nebraska Oil Jobber*, produces figures which undeniably point to the oil marketer as one of the cornerstones of his home town.

The Nebraska oil jobber is indeed a leader in civic affairs, but he is a business leader as well. During 1945 he distributed 63.5% of all gasoline sold in the state; 75.2% of the kerosine; 69.7% of the tractor fuel and 80.6% of the miscellaneous products.

This is Mr. Hahn's article as it appeared in the *Nebraska Oil Jobber*.

H. H. Hahn, executive secretary of Nebraska Petroleum Marketers Assn., who conducted survey to find out what activities—aside from oil—were engaged in by Nebraska oil jobbers

"So I submit that regardless of just what equipment and facilities are used to get petroleum products out on the final sales firing line, there will be, of economic necessity, an individual, autonomous operating unit covering as much or as little territory as his personal capabilities will permit. He is what we now call the Independent Oil Jobber."
—Warren Platt in "The Future for The Independent Oil Man."

♦ ♦ ♦

Many able writers and commentators have noted that too little was known about the Independent Jobber's real place and importance in the industry. Mr. Platt made a worthwhile contribution in 1941 when he published the book from which the above is quoted. Mr. Platt wrote further, "Heretofore, the economic worth and necessity of the jobber has been misunderstood and unappreciated by the motoring public, the Oil Industry, and even by the Jobber himself."

If little is known about his place in the marketing of petroleum products even less was known about the Independent Jobber and the place he occupies in his home community.

After all there must be some reason for the fact that the Independent Oil Jobbers of Nebraska distribute 63½% of the gasoline, 75-2/10% of the kerosine, 69-7/10% of the tractor fuel and 80-6/10% of the miscellaneous products sold in Nebraska in 1945.

It takes more than products, initiative and industry, important as they are.

NOJ sent out a questionnaire inquiring into the Jobber's place and activity in his home town.

The results amazed us. The replies came in and the information was complete and interesting. The fact is your editor does not expect to be able to transmit but a little part of the real "human interest," shown in the individual replies to his questions.

Experience

The survey showed the average jobber has over 15 years experience in the oil business.

Some of them qualify as "old timers." Six entered the oil business during or prior to World War I. Forty five entered the business in the five years following the end of World War I. The years 1925 through 1929 saw 129 enter the field and these were followed by 120 in the five years ending with 1945.

Since 1944, 147 of the jobbers started to serve as oil jobbers and tax collectors.

Whence Did They Come?

Like most of the other good things in Nebraska, more present day oil jobbers (105) came from the farm than from any other source. Seventy eight "grew up" in the business while 51 had experience in the automotive and tire field before becoming oil jobbers.

Thirty nine were attracted from the business of selling lumber, coal and grain while 37 were salesmen of other products.

The financial world is well represented

by 21 ex-bankers and 9 real estate and insurance men.

Eighteen left the grocery store and the meat counter before OPA and the red stamps could speed their going and an even dozen quit instructing in the three R's and the "T" formation to keep the wheels of America greased—and rolling.

Another dozen came from "farm implements," with experience of great value in this age of increasing mechanization of our farms, and their number is matched by those formerly engaged in trucking business.

Nine were formerly in the railroad business, 6 left public office to become public servants. No pun intended.

Then there is a scattering vote from the hardware, shoe, contracting, civil engineering, clerical, postal and plumbing trades.

All in all, it's a varied and versatile group. Its members have brought a wealth of practical experience and knowledge into the oil industry.

A Home Town Resident

He's no stranger in his home town—the average Independent Oil Jobber. Far from it—he has lived there 30 years, 4 months and 13 days.

Three jobbers—still active—have had more than 70 years to get acquainted with the home folks. Bet they can remember way back when there wasn't any income or gas tax—or automobiles or bulk plants.

Those who have spent from 50 to 70 years in the home community number 63 and there are 66 who have been getting mail at the same post office from 40 to 50 years.

Two hundred thirteen date their stay in their present homes from 1905 to 1925.

Fifty six are "newcomers" since they have been sticking around only from 10 to 20 years and 58, with less than 10 years doubtless may qualify as voters at the next city or village election.

Active in Civic Affairs

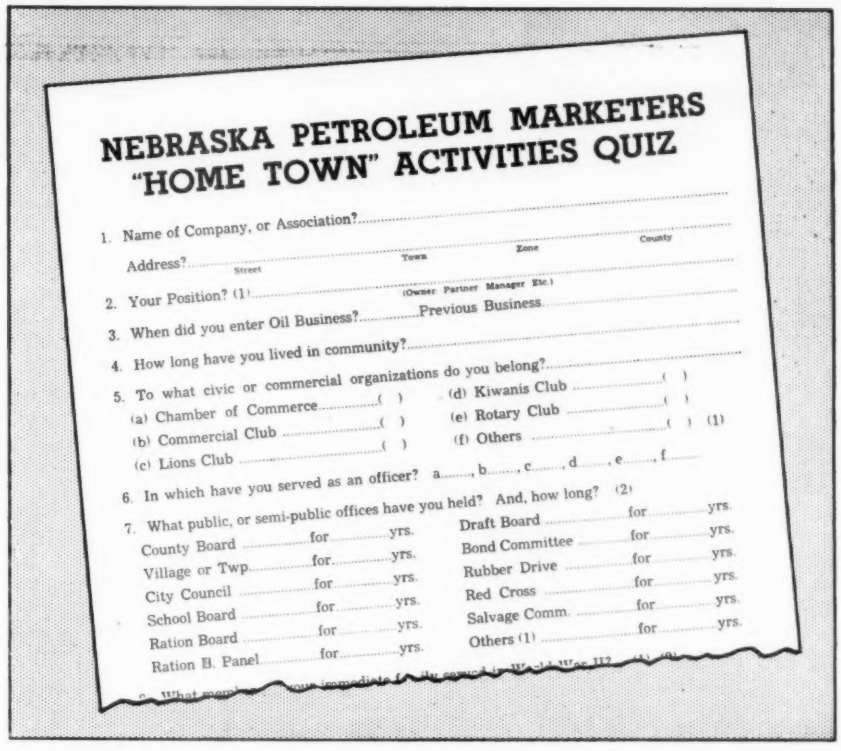
Membership in their local Chambers of Commerce, commercial clubs and business men's clubs is held by 333 jobbers. And, 150 hold, or have held, offices in those organizations.

No doubt, the number would be greater but 66 live in communities having no active civic group.

The service clubs enroll 141 oil jobber members and have had, or are getting, the services of 66 as officers. The clubs mentioned are: Cosmopolitan, Lions, Kiwanis and Rotary. One Jobber served as district governor of Kiwanis. Thirty are active members of the volunteer fire departments and 81 are interested in miscellaneous community organizations.

It is reasonable to believe the members of these organizations have a truer picture of the oil marketing business than those who assume that all oil products and policies are piped from Wall Street.

Confidential Questionnaire Sent to Nebraska Jobbers



NEBRASKA PETROLEUM MARKETERS
"HOME TOWN" ACTIVITIES QUIZ

1. Name of Company, or Association?.....
   Address?..... Street Town Zone County
2. Your Position? (1)..... (Owner Partner Manager Etc.)
3. When did you enter Oil Business?.....Previous Business.....
4. How long have you lived in community?.....
5. To what civic or commercial organizations do you belong?.....
   (a) Chamber of Commerce.....( )
   (b) Commercial Club .....( )
   (c) Lions Club .....( )
   (d) Kiwanis Club .....( )
   (e) Rotary Club .....( )
   (f) Others .....( ) (1)
6. In which have you served as an officer? a....., b....., c....., d....., e....., f.....
7. What public, or semi-public offices have you held? And, how long? (2)
   County Board .....for.....yrs.
   Village or Twp.....for.....yrs.
   City Council .....for.....yrs.
   School Board .....for.....yrs.
   Ration Board .....for.....yrs.
   Ration B. Panel.....for.....yrs.
   Draft Board .....for.....yrs.
   Bond Committee .....for.....yrs.
   Rubber Drive .....for.....yrs.
   Red Cross .....for.....yrs.
   Salvage Comm. .....for.....yrs.
   Others (1) .....for.....yrs.

Interested in Public Affairs

Oil jobbers—like all good citizens are interested in the education of our youth. This is evidenced by the services performed by 141 jobbers as members of school boards.

Just as close to "home"—and to the jobber—is his home town city council or village or township board. One hundred thirty two have gained experience in taxation and other public matters through service on city councils and 78 on village and township boards.

In view of the fact that all these public bodies have a great deal to do with property taxes, it would appear the oil jobbers with this experience could speak with greater authority and assurance, on all tax matters—including the gasoline tax, state and federal.

In semi-public activities, the survey shows that nearly every oil jobber took an active part in the industry's rubber drive. Nearly as many served on bond sales and salvage committees. Sixty seven served on ration boards or ration board panels while 21 did their bit in the war on Selective Service Boards.

Fifty one are active in Red Cross and 66 in miscellaneous drives and campaigns.

Family Went to War

Three hundred ninety three members of jobbers' families went to war. The compilation is as follows: 219 sons, 9 daughters, 135 brothers, 15 grandsons and 15 jobbers themselves.

Indications are that many more went. Quite a few questionnaires came back with no information on this point.

Over One Thousand Employees

Twelve hundred thirty three employees entered the service of their country and reports indicate that 522 have returned to their former employment. That's quite a contribution of man power. Sixteen hundred twenty six relatives and employes!

Has Property Interest

Three hundred and ninety jobbers have town property or interests entirely apart from the oil business.

One hundred fifty nine have further diversified their property interest through the ownership of farms and ranches.

One hundred forty four have both town and farm properties.

This fact alone shows that oil men's tax interests are not confined to taxes imposed on gasoline and motor vehicles.

The oil jobber, too, is a property owner and so can meet his customers and fellow townsmen on common ground whenever taxes are under discussion.

Probably he can speak on the subject of taxes—and their effects on the average motor vehicle, home or farm owner with more conviction than any other business man in his home town.

Certainly, he need feel no hesitation in speaking plainly on matters affecting his business—or his customers. His position in his home community is such that his views will be received with attention and respect.

He has earned the right to speak.

He should excercise that right.

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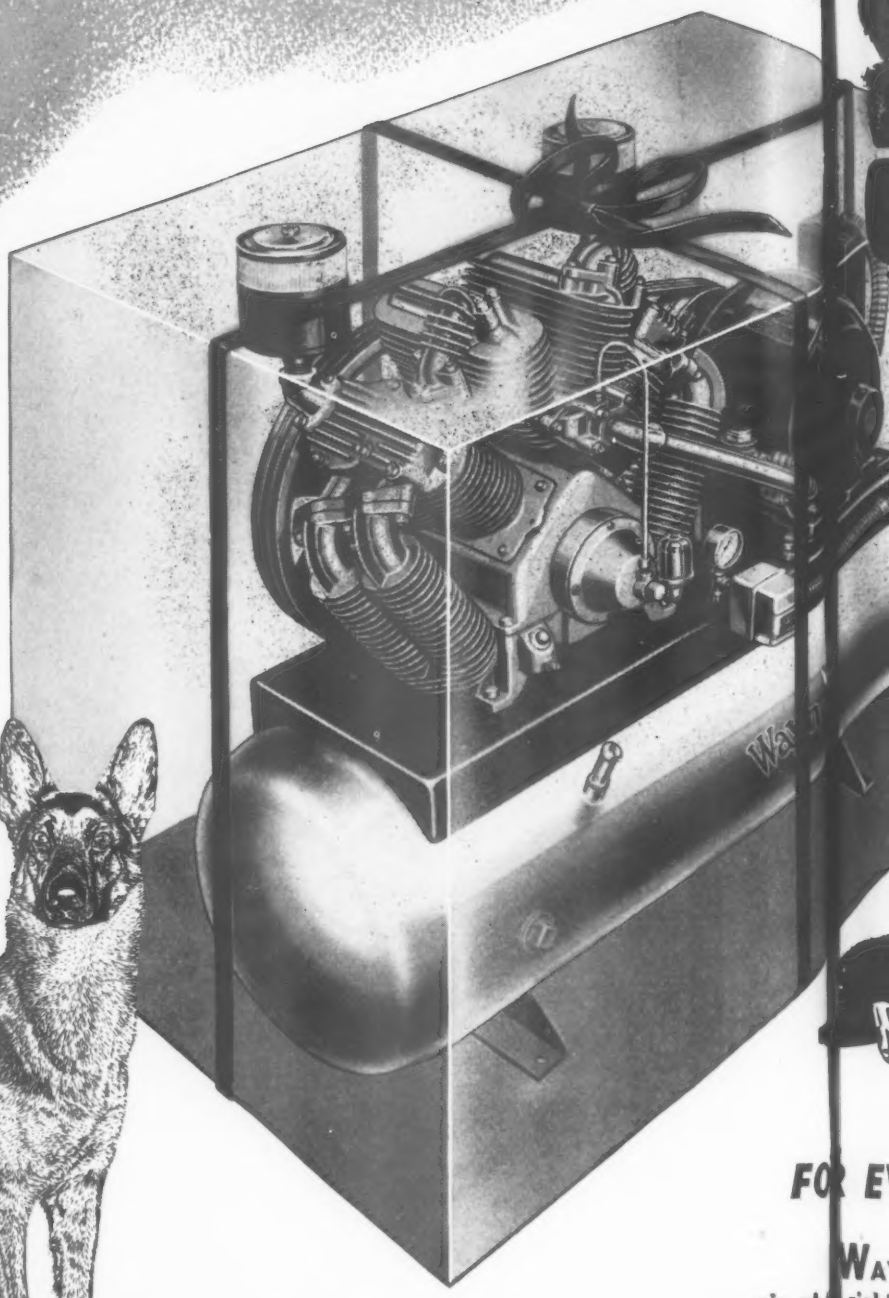
Wayne builds a complete line of One- and Two-Stage Air Compressors ranging from ¼ H. P. to 10 H. P.



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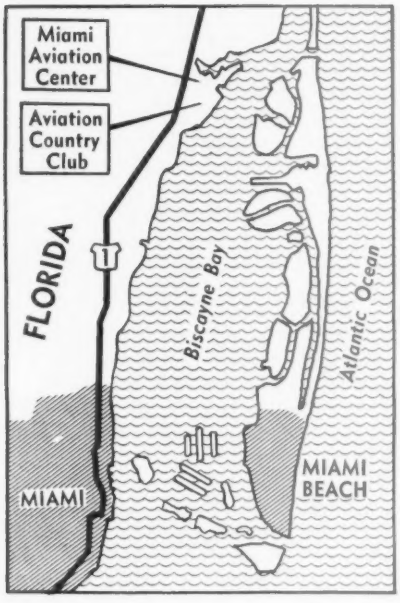

Located on a busy highway and also on Biscayne Bay, the Miami Aviation Center in addition has hard surface runways for private planes

By NPN Staff Writer

MIAMI, Fla. — Land planes, sea planes, boats, passenger cars, and trucks will be fueled and lubricated at a unique service base that is being built by Miami Aviation Center at 123d Street and Biscayne Boulevard.

At the moment it is 458 acres of open land between U. S. 1 and Biscayne Bay, owned and being developed by Richard Flynn and Jack Keefe. The airport is in operation. Hard surface runways are in—probably the only ones on a privately owned and operated field. A new concrete office building and operations center is being finished. Already 15,000 gal. of aviation grade fuel is being sold a month.

For boats, dredges are cleaning out and deepening a water channel that runs in from the Bay on the south end of the property.

Plans are being drawn for an automobile service station that will serve traffic on Biscayne Boulevard and U. S. 1. The $25,000 service station structure will be erected as soon as materials and labor are available.

Flynn and Keefe, who are statewide distributors for Ercoupe civilian planes, also plan an elaborate showroom for planes on the Boulevard. It will vie with the finest automobile showrooms. Currently the plane they distribute is a 2-passenger ship selling for $3150. Six planes have been sold this year and over 20 have been sold in Miami since they started.

The service for land planes—service for sea planes—boat service—automobile service station—sales and showrooms for planes—modern airport—these are only a part of this unique air-age development. An Aviation Country Club on the bay front—homes, each with private hangar for plane-owning residents—overnight accommodations for visiting flyers—restaurants—and rental cars for flyers who need passenger cars while in Miami are also part of the program.

It is hoped that the first home for a flying family will be started before the end of another month. It will be a complete, modern house and garage with a hangar for the owner's plane. So far, 80 such lots have been plotted in the north half of the 458 acres of the project.

Caters to Private Planes

The airport itself will cater entirely to private, non-commercial traffic. The Aviation Country Club will have a building that will bring country club social life into the age of air travel. Instead of driving out into the country for a round of golf and dinner, a member from New York may fly down to spend a week-end with some friends who have flown over from Houston or Kansas City.

There are few places in the United States where such an ambitious and extensive development could be made a year-round business.

Most of the projected buildings and services are still in the agile minds of Richard Flynn and Jack Keefe. After long daytime hours of handling the existing business and construction at the airport (50 planes were on the ground the day we visited with them), their evenings and nights are devoted to organizing and planning the many units of this future land-sea-and-air base for civilians.

While it is impossible to gauge accurately the potential for petroleum products, the sale of aviation grade, automotive and marine fuels and lubricants could pass a million gallons a year when all units are completed.

Today the owners are building structures as fast as materials will allow. At the same time, they are building an organization of men that will put the many enterprises planned for this 458-acre center on an efficient profitable basis.

Coleman, Tanham to Lead Panels at NPA Meeting

NPN News Bureau

CLEVELAND—Stewart P. Coleman of Standard Oil Co. (N. J.) and James Tanham of The Texas Co. will lead panel discussions at the 43rd semi-annual meeting of the National Petroleum Assn. here on April 18-19 at Hotel Cleveland. NPA members were overwhelmingly in favor of continuing the round-table discussions inaugurated at the Atlantic City meeting last year.

Mr. Coleman's panel is on "Trends of Petroleum Economics" and Mr. Tanham's discussion is titled "Future Industrial Relations in the Petroleum Industry."

Harry A. Logan, United Refining Co., Warren, Pa., president of NPA, will open the meeting with the president's address.

Following is the two-day program:

Thursday, April 18

Noon—NPA members and guests are invited to luncheon meeting of the Petroleum Club of Cleveland. W. T. Holliday, Standard Oil Co. (Ohio) will be chairman of the program.

2 p. m.—President's address by Mr. Logan.

Following Mr. Logan will be Fred G. Clark, American Economic Foundation, New York, who will discuss industrial problems and application of economic factors to them.

Merle Thorpe, Petroleum Advisors, Inc., New York is scheduled to appear after Mr. Clark, on a subject not yet announced.

6:30 p. m.—Fellowship supper, main ball room of Hotel Cleveland. Hosts will be Allied Oil Corp., Canfield Oil Co., United Refining Co. and Standard Oil Co. (Ohio).

Friday, April 19

10 a. m.—Panel discussions. Stewart P. Coleman, Standard Oil Co. (N. J.) will lead discussion on "Trends of Petroleum Economics."

James Tanham, The Texas Co., New York, will lead a panel discussing "Future Industrial Relations in the Petroleum Industry."

Brig. Gen. Albert J. Browning, Director of the Office of Domestic Commerce, Department of Commerce, who will discuss government business relationships in the postwar world.

Group meetings of the Department of Traffic and Transportation, Department of Manufacture, Department of Standards and Tests and Department of Industrial Relations, are to be announced at a later date.

Serving on the NPA program committee are J. B. Fisher, vice president, Kendall Refining Co., W. S. Zehrung, president of Pennzoil Co., J. Howard Marshall, president of Ashland Oil & Refining Co., W. W. Vandeveer, president Allied Oil Co., and Sidney A. Swensrud, vice president, Standard Oil Co. (Ohio).

Fayette B. Dow, general counsel, points out that this is the first meeting which NPA has held at Cleveland since April 1942, and because of the outstanding program anticipates a large attendance, necessitating early advance reservations.

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Text of Veterans' Housing Program Order 1

WASHINGTON — Following is text of Veterans' Housing Program Order 1 issued by Civilian Production Administration on March 26:

GENERAL RESTRICTIONS ON CONSTRUCTION AND REPAIRS

The Veterans' Emergency Housing Program, set forth February 7, 1946, by the Housing Expediter in his report to the President, calls for the construction of an unprecedented number of moderate and low-cost housing accommodations to meet the needs of returning veterans. The fulfillment of requirements for the defense of the United States has created a shortage in the supply of materials and facilities required for construction, for defense, for private account and for export. It will be impossible to carry out the Veterans' Emergency Housing Program without diverting critical materials from deferrable or less essential construction. The following order is deemed necessary and appropriate in the public interest and to promote the national defense.

Section 4700.1 — Veterans' Housing Program Order 1. (a) **What this order does.** In order to carry out the Veterans' Emergency Housing Program, this order forbids the beginning of construction and repair work on buildings and certain other structures without specific authorization under paragraph (h) of the order, with the exception of certain small jobs and other work covered by paragraphs (d), (e) and (f). The restrictions of the order apply whether or not the materials needed are on hand or are available without priorities assistance.

(b) **Structures and work covered by this order.** (1) **Kinds of structures.** The restrictions of this order apply to certain kinds of work on structures. As used in the order, "structure" means any building, arena, stadium, grandstand, pier, moving picture set or billboard, whether of a permanent or temporary nature (however, the erection of stands or other structures which have been used before and are being erected only for a temporary purpose and are to be taken down after the temporary purpose is served is not covered by the order). The term "structure" does not include roads, streets, sidewalks, railroad or street or interurban or plant railway tracks or operating facilities (other than buildings), fences, silos, trailers (except when demounted and installed on a foundation), bridges, tunnels, subways, pipe lines, utility facilities (except buildings) providing for electric, gas, sewerage, water, central steam heating or telephone or telegraph communication services including power or utility lines and sewers surface or underground mines, wells, dams, canals or drainage or irrigation ditches. The term "structure" also does not include anything that is not attached to the land or to a structure as defined above, or any kind of equipment installed outside of and not attached to a building or other structure.

(2) **Kinds of work.** The restrictions of this order apply to constructing, repairing, making additions or alterations (including alterations incidental to installing any kind of equipment), improving or converting structures, or installing or relocating fixtures or mechanical equipment in structures. These terms include any kind of work on a structure which involves the putting up or putting together of processed materials, products, fixtures or mechanical equipment, if the processed materials, products, fixtures or mechanical equipment are attached to the land, or are attached to a structure and used as a functional part of the structure, or are attached so firmly to the land or structure that removal would injure the material, product, fixture or mechanical equipment or the structure. The laying of asphalt or other tile or linoleum cemented or otherwise attached to the structure is covered by the order. However, repainting, repapering, and sanding floors, and greasing, overhauling, repairing or installing repair or replacement parts in existing mechanical equipment in all types of structures, where no change in the structure is made, are not covered by the order.

(3) **Fixtures and Mechanical equipment.** The term "fixture" means any article attached to a building or structure and used as a part of the building or structure. The term "mechanical equipment" means any equipment which is used to operate a building or other structure. The following items are included within the phrase "fixtures and mechanical equipment" if they are attached to the building or structure in any of the ways indicated later in this paragraph: Plumbing, heating, ventilating and lighting equipment, panelling, bookcases, bars, soda fountains, show cases, booths, wood or metal partitions, counters, and the like. These articles are considered to be attached to a building or structure if they are attached by nails or screws to the building, if they are connected to the plumbing or other piping system of the building, if they are connected to the lighting system of the building (except by connection to an existing outlet), or if a base or foundation is built for the item, or if the item is cemented to the building or structure. The phrase "fixtures and machinical equipment" does not include the following: Machine tools, blast furnaces, conveyors, elevators, process piping, control or testing equipment used for industrial or utility purposes or in a laboratory, power generating or transmitting equipment, such as boilers, generators, transformers, and the like (however, where the purpose of boilers, transformers and similar equipment is primarily to provide electricity or steam for lighting or heating the building in which they are installed, they would be mechanical equipment), medical equipment in a hospital, washing machines, or dryers in a commercial laundry, compressors or cooling equipment in a cold storage warehouse or frozen food locker plant, gasoline pumps and hydraulic lifts in a garage or service station, and stoves, refrigerators (other than refrigerators constructed as an integral part of a building), food-warming equipment and dishwashing equipment in a restaurant.

(c) **Prohibited construction.** (1) No person shall begin to construct, to repair, to make additions or alterations to, to improve, to convert from one purpose to another, or to install or to relocate fixtures or mechanical equipment in, any structure, public or private, in the forty-eight states and District of Columbia, Puerto Rico or the Virgin Islands, except to the extent permitted under paragraphs (d), (e) and (f), or when and to the extent specifically authorized under paragraph (h). No person shall carry on or participate in any construction, repair work, addition, improvement, conversion, alteration, installation or relocation of fixtures or mechanical equipment prohibited by this order. The prohibitions of this paragraph apply to a person who does his own construction work, to a person who gets a contractor to do the work, to contractors, subcontractors, architects and engineers working on a job which is being carried on in violation of this order or getting

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When fire breaks out in a room housing a flammable liquid or electrical equipment hazard, a Kidde total flooding system extinguishes the flames in 20 seconds—or even less.

As the name indicates, a total flooding system, by discharging carbon dioxide into the protected area, dilutes the oxygen content within the entire room to a point where fire can no longer exist. Such a system can be engineered for either automatic or manual discharge of the carbon dioxide.

Carbon dioxide capacities are calculated on the basis of the size of space to be protected, with adequate allowance for leakage through openings. For full details on total flooding systems write Walter Kidde & Company, Inc.

back to Shanghai. I want to return to China and still work with my company."

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For a quick-reading summary of the outstanding advantages of Trigger-grip Control (now standard on all Kidde Hand Portable Extinguishers) write for free copy of 4-page bulletin AD531. Walter Kidde & Company, Inc., 443 Main Street, Belleville 9, N. J.

library, auditorium, music room, gymnasium ... door swimming pool. One complete wing will be devoted to hospital facilities.

... previously acknowledged that the separati... were operating in Khamseh, armed with weapons which were distributed by unknown people.

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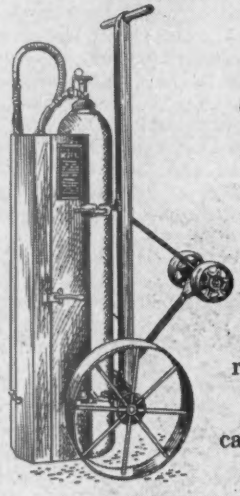

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No special training needed to operate the Model 15 Portable. Just aim at the fire and pull the trigger! Same design available in 10 and 20-pound capacities.

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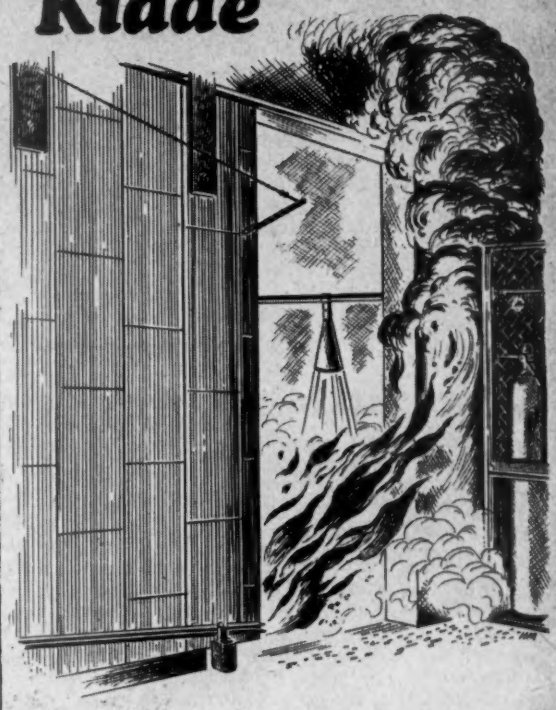

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Process rooms and other hazardous areas can be automatically isolated, if desired, as part of the operation of Kidde built-in systems. Release of the carbon dioxide actuates trips which allow fire doors and windows to close. Time delay mechanisms allow workers plenty of time to leave before doors close.

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Disorders Break Out

General output at factories and mines decreased 4 per cent in October, while in the first half of November ... output of ... basic industries ... leum

Bill May Force

... stationed in a little town in France for several months, wooed a French girl by telling her about ... the ... ans ... into ...

others to work on it or to supply materials for it.

(2) This order forbids the beginning of certain kinds of work. To "begin" work on a structure means to incorporate into a structure on the site materials which are to be an integral part of the structure in question. Demolition, excavation and similar site preparation do not constitute beginning construction. The order does not apply to work which was begun before March 26, 1946, and which was being carried on on that date and which is carried on normally after that date. However, this rule only applies to the particular building or other structure begun before March 26, 1946. It does not apply to any other building or structure which had not itself been begun by that date even though the two are closely related.

(d) **Exemption for small jobs.** (1) This order does not restrict a construction, repair, alteration or installation job, the cost of which does not exceed allowance given below for the particular kind of structure involved:

(i) $400 for a house or other structure (such as a garage) on residential property designed for occupancy by five families or less. This allowance also applies to farmhouses and other housing accommodations on farms, except bunkhouses and other accommodations for transitory farm laborers.

(ii) $1,000 for a hotel, resort, apartment house, or other residential building designed for occupancy by more than five families.

(iii) $1,000 for a building used primarily for one or more commercial or service establishments such as offices, banks, stores, laundries, garages, restaurants, night clubs, theaters, repair shops, warehouses, frozen food locker plants and radio stations.

(iv) $1,000 for a farm, excluding farm houses which are covered by paragraph (d) (1) (i) above. A farm means a place used primarily for raising crops, livestock, dairy products or poultry for the market.

(v) $1,000 for a church, hospital, school, college or a publicly owned building used for public purposes, or for an orphanage or other building used exclusively for charitable purposes.

(vi) $15,000 for a factory, plant or other industrial structure which is used for the manufacturing, processing, or assembling of any goods or materials for a logging and lumber camp, for a pier (other than a pier designed for amusement, entertainment or other commercial purposes), for a structure used for or in connection with a railroad or street railway or a commercial airport, for a bus terminal, for a truck terminal operated by a common or contract carrier by truck, or for a research laboratory or pilot plant or for a motion picture set. This allowance is applicable to structures used for oil, gas or petroleum producing, refining, or distributing (except service stations and garages which are covered by paragraphs (d) (1) (iii) above). It is also applicable to utility structures (public or private) providing for electric, gas, sewerage, water, central steam heating, or telephone or telegraph communication services.

(vii) $200 for a structure covered by this order which does not fall within one of the classes listed above.

(2) For the purpose of determining whether a particular job is exempted from this order by paragraph (d), the "cost" of a job means the cost of the entire construction job as estimated at the time of beginning construction. This includes cost of paid labor engaged in the construction work, regardless of who pays for it, the cost or value of new fixtures, mechanical equipment and materials incorporated in the structure, whether or not obtained without paying for them, and the amount paid for contractors' fees. It does not include the cost or value of previously used fixtures, mechanical equipment and materials, the value of unpaid labor, or the cost or value of machinery and equipment (other than mechanical equipment) or the cost of labor engaged in assembling and installing the machinery and equipment.

(3) For the purpose of this exemption, a related series of operations which are performed at or about the same time or as part of a single plan or program constitute a single job. No job which would ordinarily be done as a single piece of work may be sub-divided for the purpose of coming within this exemption. When a building or part of a building is converted from one purpose to another, all work incidental to and done in connection with the conversion must be counted as one job. So also if a building is being renovated, improved or modernized over an extended period, all work done in connection with the modernization (other than work done before March 26, 1946) must be considered as part of one job, even though separate contracts are let for the different parts of the work. The definition of a job given in this paragraph may not be used in determining whether construction has started prior to the issuance of the order under paragraph (c) (2).

(4) If a structure is used for more than one purpose and might therefore fall within more than one of the classes indicated, the use to which the greatest part of the structure will be put (computed on the basis of the floor area where applicable) determines the allowance. If a structure is being converted from one purpose to another, the allowance applicable to the structure after the conversion is the maximum allowance for the conversion. The allowances given for jobs on a structure apply to all subordinate or related structures situated near and used in connection with the structure.

(e) **Exemption for repair and mainte-**

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A fourth reason is—International Truck Service backs International Trucks, and this service is unsurpassed both for quality and availability. It is supplied by International Truck Dealers everywhere, and by International Branches—the nation's largest company-owned truck-service organization.

And a fifth reason is—International's 15-year record of more heavy-duty Internationals purchased for civilian use than any other make.

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And keep old trucks operating economically with International Service until your new Internationals come.

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INTERNATIONAL Trucks

nance work in industrial utility transportation buildings and structures. The prohibitions of this order do not apply to maintenance and repair work in structures covered by paragraph (d) (1) (vi) of this order. For the purpose of the exemption given by this paragraph, "maintenance" means the minimum upkeep necessary to keep a structure in sound working condition and "repair" means the restoration of a structure to sound working condition when the structure has been rendered unsafe or unfit for service by wear and tear, damage, failure of parts, or the like. However, neither maintenance nor repair includes the improvement of any structure by replacing material which is still usable with material of a better kind, quality or design. No maintenance or repair work which is capitalized by the person doing the maintenance or repair work may be performed under this exemption. Alterations to a building or other structure covered by paragraph (d) (1) (vi), including alterations incidental to installation of equipment, are not exempted by this paragraph, even though they are not capitalized, and may only be done when and to the extent permitted under paragraph (d) or when specifically authorized.

(f) **Other exemptions.** (1) **Disasters.** (i) The prohibitions of this order do not apply to the minimum work necessary to prevent more damage to a building or structure (or its contents) which has been damaged by flood, fire, tornado, or similar disaster. This does not include the restoration of the structure to its former condition.

(ii) The prohibitions of this order do not apply to the repair, rebuilding or reconstruction of any house (including a farmhouse) or any farm building which was destroyed or damaged by fire, flood, tornado or similar disaster, if the total cost of the repairs, rebuilding or reconstruction does not exceed $6,000 and if the reconstruction is started within 60 days of the occurrence of the disaster.

(2) **Military construction.** The prohibitions of this order do not apply to work by or for the account of the U. S. Army or Navy.

(3) **Veterans' Administration.** The prohibitions of this order do not apply to work on construction projects of the Veterans' Administration, including projects being built by the Corps of Engineers for the Veterans' Administration, or the remodeling of a building or any part of a building which has been leased to the Veterans' Administration or to Public Buildings Administration for occupancy or use by the Veterans' Administration.

(g) **Prohibited deliveries.** No person shall accept an order for, sell, deliver or cause to be delivered materials which he knows or has reason to believe will be used in work prohibited by this order.

(h) **Authorizations.** Persons who wish to begin work which is prohibited by this order may apply for authorization. If the application covers housing accommodations under Priorities Regulation 33 (including farm dwellings), it should be made on Form CPA 4386. Applications for non-farm housing accommodations should be filed with the local office of the Federal Housing Administration. Applications covering housing accommodations on a farm should be filed with the appropriate County Agricultural Conservation Committee. The assignment of ratings for or approval of housing accommodations under Priorities Regulation 33, whether before or after the issuance of this order, constitutes an authorization under this order to do the work for which priority assistance or approval was given under that regulation. If the application covers work on a farm (other than farm dwellings), the application should be made on Form CPA 4423 and should be filed with the appropriate County Agricultural Conservation Committee. If work on any other kind of structure is involved, the application should be filed on Form CPA 4423 with the appropriate Construction Field Office of the Civilian Production Administration. Applications will be reviewed to see whether and how much the proposed construction would interfere with the Veterans' Emergency Housing Program. In addition, the essentiality of the proposed work in relation to the Veterans' Emergency Housing Program, to the elimination of a bottleneck to the reconversion of the national economy from a wartime to a peacetime basis, to the public health and safety of the community, or to eliminate an unusual and extreme hardship will be taken into consideration in determining whether the application should be approved. In case of emergency, a request for authorization may be made by telegram to the appropriate Civilian Production Administration Construction Field Office. The telegram should state the nature of the emergen-

Reproduction of Page One of CPA Building Application Form

FORM CPA-4423
(3-26-46)

UNITED STATES OF AMERICA
CIVILIAN PRODUCTION ADMINISTRATION

BUDGET BUREAU NO. 13-R2712
APPROVAL EXPIRES MAY 31, 1946

APPLICATION FOR AUTHORITY TO CONSTRUCT
(NON-HOUSING)
INCLUDING ALTERATIONS AND REPAIRS TO
EXISTING STRUCTURES

(SEE INSTRUCTIONS ON REVERSE SIDE)

CASE NO.

DATE RECEIVED

2. (Check which)
- ☐ A NEW APPLICATION
- ☐ AMENDMENT
- ☐ RECONSIDERATION

1. NAME AND ADDRESS OF APPLICANT (Street, City, Zone, State)

TELEPHONE

3. LOCATION OF PROJECT (Give street number, city and state, and for rural construction, give county and township)

4. DESCRIPTION OF PROJECT (Submit a plan or sketch showing principal dimensions)

a. IF APPLYING FOR AUTHORITY FOR NEW CONSTRUCTION, GIVE A CLEAR, CONCISE DESCRIPTION OF THE CONSTRUCTION, INCLUDING THE PROJECT LIMITS, SIZE AND LAYOUT OF STRUCTURES, AND THE TYPE OF CONSTRUCTION INVOLVED, i.e., MASONRY (Specify kind), REINFORCED CONCRETE, LIGHT OR HEAVY WOOD FRAME, ETC.

b. IF APPLYING FOR AUTHORITY TO ALTER AND REPAIR EXISTING STRUCTURES, DESCRIBE IN DETAIL THE EXTENT OF THE WORK TO BE DONE.

5. ESTIMATED COST OF PROJECT (Excluding land, existing structures, and architects and engineer's fees)

	DOLLARS
COST OF STRUCTURES, INCLUDING FIXTURES AND BUILDING SERVICE EQUIPMENT (MECHANICAL EQUIP.)	
COST OF PROCESSING EQUIPMENT EXCLUDING RE-USED EQUIPMENT	
TOTAL	

6. PROPOSED SCHEDULE

	NUMBER
DAYS BETWEEN RECEIPT OF AUTHORIZATION AND START OF CONSTRUCTION	
DAYS FROM START OF CONSTRUCTION TO COMPLETION	

7. PROPOSED USE OF PROJECT

DESCRIBE FULLY THE PRINCIPAL SERVICES TO BE RENDERED OR PRODUCT TO BE PRODUCED, AND STATE ALSO THE AREA NORMALLY COVERED IF A SERVICE OR UTILITY TYPE PROJECT.

SPACE BELOW FOR USE OF PROCESSING AGENCY

AUTHORIZATION OR DENIAL - YOU ARE HEREBY AUTHORIZED, UNLESS DENIED BELOW, TO CONSTRUCT THE PROJECT OR DO THE WORK DESCRIBED IN THIS APPLICATION, SUBJECT TO THESE CONDITIONS: THE CIVILIAN PRODUCTION ADMINISTRATION IN GRANTING THIS AUTHORIZATION RELIED ON THE STATEMENTS AND REPRESENTATIONS MADE BY THE APPLICANT; FAILURE TO ABIDE BY THESE STATEMENTS AND REPRESENTATIONS, OR TO SUPPLY SUCH ADDITIONAL INFORMATION AS MAY BE REQUIRED UPON WRITTEN REQUEST (WITH APPROVAL OF THE BUREAU OF THE BUDGET) CONSTITUTES A VIOLATION OF THIS AUTHORIZATION AND GROUNDS FOR ITS IMMEDIATE CANCELLATION.

DATE OF AUTHORIZATION

SERIAL NUMBER

BY

SIGNATURE

GPO—CPA 17944—p. 1

cy (fire, flood, etc.), the use to which the building will be put, the type of construction, the estimated cost of construction and the reasons why immediate reconstruction is necessary.

(i) **Construction under authorizations.** When a person is specifically authorized, either by approval of Form CPA 4423 or Form CPA 4386 or otherwise, to do work restricted by this order, he must observe the restrictions imposed on him by the authorization, and in doing the authorized work, he must not do any work of the kinds covered by the order unless it is specifically covered by the authorization. He may not, in connection with a job which has been specifically authorized, do additional work under the exemption given by paragraph (d). When an application on Form CPA 4423 has been approved a placard will be sent to the applicant stating that the construction has been approved under this order. The applicant must place in the placard the project serial number and must set up the placard in front of the project site in a conspicuous location within five days after construction has been started and he must keep placard there until completion of the building.

(j) **Violations.** Any person who wilfully violates any provision of this order or who, in connection with this order, wilfully conceals a material fact or furnishes false information to any department or agency of the United States is guilty of a crime, and upon conviction may be punished by fine or imprisonment. In addition, any such person may be prohibited from making or obtaining further deliveries of, or from processing or using material under priorities control, and may be deprived of priorities assistance.

(k) **Communications.** All communications concerning this order should be addressed to the Civilian Production Administration, Washington 25, D. C., Ref: VHP-1.

(l) **Reports.** All persons affected by this regulation shall file such reports as may be requested by the CPA, subject to the approval of the Bureau of the Budget in accordance with Federal Reports Act of 1942.

Issued this 26th day of March, 1946.

CIVILIAN PRODUCTION ADMINISTRATION

By J. Joseph Whelan
Recording Secretary

Page Two of CPA Form Calls for Justification of Project

FORM CPA-4423 (1-26-46)

8. JUSTIFICATION FOR THE PROJECT

a. STATE IN DETAIL THE NEED FOR THE PROJECT, GIVING THE RELATIONSHIP OF THE PRODUCTION OR SERVICE TO THE VETERANS EMERGENCY HOUSING PROGRAM, TO OTHER ESSENTIAL CIVILIAN NEEDS, OR TO PUBLIC HEALTH AND SAFETY.

b. STATE THE SPECIFIC REASONS THE PROJECT CANNOT BE DEFERRED AT THIS TIME.

c. GIVE ANY OTHER FACTORS IN SUPPORT OF THIS APPLICATION.

INSTRUCTIONS

The applicant must be the person who is, or is to be, the owner of the proposed project, or his duly authorized representative. All copies of the application must be signed and dated by him or his authorized representative.

The applicant should prepare *four (4) copies* of this form, retain one and file the original and *two (2) copies*, as directed below:

For non-housing construction on farms, file with the County Agricultural Conservation Committee having jurisdiction over the site.

For all other non-housing construction, file with the nearest Construction Field Office of the Civilian Production Administration.

If requesting authorization for changes in an authorized project, file CPA-4423, indicating the extent of change from the original description, with the same office where the original application was filed.

9. CERTIFICATION AND CRIMINAL CODE

THE UNDERSIGNED HEREBY CERTIFIES THAT HE IS THE APPLICANT OR THAT HE IS AUTHORIZED TO EXECUTE THIS APPLICATION ON BEHALF OF THE APPLICANT; THAT THE FACTS HEREIN SET FORTH, OR APPENDED, ARE TRUE AND CORRECT TO THE BEST OF HIS KNOWLEDGE AND BELIEF, AND THAT THE PROJECT OR WORK DESCRIBED HEREIN WILL BE CARRIED OUT IN ACCORDANCE WITH THE DESCRIPTION GIVEN.

BY _____
NAME OF APPLICANT — SIGNATURE OF APPLICANT OR AUTHORIZED REPRESENTATIVE

DATE — TITLE

SECTION 35 (A) OF THE UNITED STATES CRIMINAL CODE, 18 U.S.C. SEC. 80, MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

GPO—CPA 17944—p. 2

Oil Economist Sees Oil Demand In 1946 Up 10% Over 1941

NPN News Bureau

NEW YORK — Demands for petroleum products will be 10% greater this year than in 1941, A. J. McIntosh, economist, Socony-Vacuum Oil Co., Inc., told the Assn. of Customers Brokers at the New York Stock Exchange on March 26.

The trend will continue upward at the rate of about 3% a year until 1950 and then a recession in the country's general economy probably will affect the volume of petroleum consumption, according to Mr. McIntosh.

Although there will be fewer automobiles in use in 1946 than prewar, the total demand for gasoline will be equal to that of 1941, Mr. McIntosh stated, because of the increased activities in aviation, truck and bus transportation.

By 1950, Mr McIntosh predicted that there will be 3,750,000 home burners in use in this country, which should double the amount of home-heating fuel used as compared with 1939.

In discussing the outlook on exports, Mr. McIntosh said that the United States probably will export 595,000 b/d this year but that this total will decline in the following years as refineries abroad are rebuilt to handle the demands.

Referring to a recent study made of the operations of 103 oil companies from 1926 to 1944, Mr. McIntosh said that a company's net domestic earning is one cent a gallon on its integrated operations—exploring, producing, transporting, manufacturing and marketing the product to the dealer.

Oil Equipment Man to Talk

INDIANAPOLIS — Oil marketing equipment manufacturers are participating in the 33rd annual conference of Indiana Assn. of Inspectors of Weights & Measures to be held at Terre Haute, April 10-12. William Louthan, Service Manager for Tokheim Oil Tank & Pump Co. will address the conference on "nuisance requirements" of state authorities that might be eliminated.

John P. McBride, Boston, head of Massachusetts Weights & Measures Dept., will talk on drafting regulations. He is also chairman of the association's Specification and Tolerance Committee. Twelve of the 32 questions to be discussed in open forum pertain to oil marketing equipment.

Signs Bill Increasing 'Gas' Tax

Special to NPN

RICHMOND, VA.—Gov. Tuck has signed legislation increasing state gasoline tax from 5c to 6c.

New law also provides for repeal of 2% gross receipt tax on common and contract carrier trucks, increases common carrier license fees 150% and contract carrier fees 50% and reduces passenger car license fees 20%. Gov. Tuck in recent speech estimated revenue from new taxes will total $3.500,000.

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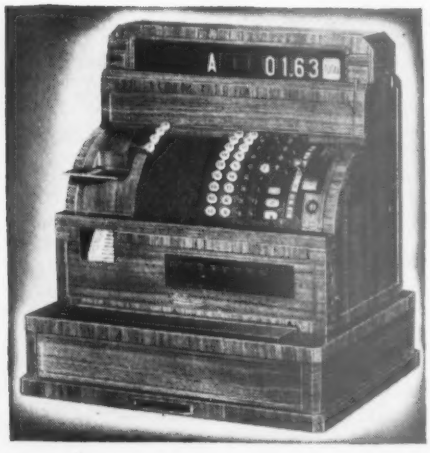
"Before installing a National Cash Register we had no way of systematizing our business. We could not tell where losses were occurring.

"Now we know where we are making the money and where we are losing and we are able to concentrate on the items that will bring us the greatest profit. We are convinced that we couldn't afford to be without the control and information provided by a National Cash Register. It has given us results we've never obtained before."

The service given by National Cash Registers has resulted in many thousands of statements like this from enthusiastic users. Businessmen all over the country have discovered that National Cash Registers help them save time, money and provide increased control and information about their businesses.

Call your local National representative and let him demonstrate the advantages of the right National Cash Register System for your service station.



See the National Cash Register for Service Stations

This National Cash Register is designed for use in service stations. It records sales made in each of five departments and identifies the persons who ring up the sales. It also shows amount of money paid out. In addition, the register prints a receipt on every transaction which shows the date, operator's initial, amount, department or kind of transaction, and the consecutive number of the transaction. A printed history of each transaction is provided on the detailed audit-strip. Ask your National representative for a demonstration. The National Cash Register Company, Dayton 9, Ohio. Offices in principal cities.

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New England Oil Men's Convention Program Set

Special to NPN

BOSTON—Program for 22nd annual convention of Independent Oil Men's Assn. of New England, April 11-12 here at Hotel Statler, has been completed. Agenda for two-day parley includes this line-up

Thursday, April 11

Noon—Registration, mezzanine desk.
2-4 p.m.—Movies of industry, Parlor A, mezzanine floor.
6 p.m.—Oil Men's Night Club, banquet hall.

Friday, April 12

9 a.m.—Registration, mezzanine desk, chairman, W. M. Little.

10:30 a.m.—Parlor E, mazannine floor: **"Portwar Credit Control,"** round table conducted by C. M. Matheson, division credit manager, Cities Service Oil Co., Boston and chairman of Eastetrn Petroleum Credit Group; **"Catalytic Oil,"** Parlor F, mezzanine floor, round table conducted by A. B. Culbertson, manager, products application department, Shell Oil Co., New York; **"Motor Truck Operation,"** Parlor D, mezzanine floor, round table conducted by J. A. Hassey, superintendent of operations, Cities Service Oil Co., Boston, and president Massachusetts Motor Truck Assn.

11 a.m.—Oil Men's Town Meeting, Georgian Room, mezzanine floor: **"Salesman's Compensation,"** with Sterling Mudge, supervisor of training, Socony-Vacuum Oil Co., New York, acting as moderator, and Charles Whitney, vice president in charge of sales, Petrol Corp., Philadelphia, and A. R. Martin, assistant to general sales manager, Standard Oil Co. of New Jersey, New York.

1 p.m.—Luncheon, banquet hall: **"The Science of Service Is the Backbone of Business,"** address by Capt. A. A. Nichoson, assistant to the vice president, The Texas Co.; banquet chairman, H. E. Davenport, association vice president; presentation of speaker by Ben Halsell, division manager, The Texas Co., Boston.

5-6 p.m.—Coctail Hour, Georgian Room, mezzanine floor.

6:30 p.m.—Banquet, Ballroom: **"What to Expect From Russia,"** address by John Scott, foreign editor, *Time Magazine;* banquet chairman, John P. Birmingham, association president; Gov. Maurice L. Tobin, guest of honor.

Buys Florida Terminal

Special to NPN

FREEPORT, Fla.—Sanford Service Co., De Funiak Springs, Fla., petroleum products towing company, has entered the gasoline and kerosine business with the purchase of the local terminal of the Citizens Oil Co. here. The plant has approximately 2,000,000 gal. storage capacity.

The plant will be used for the servicing of independent dealers in Sanford Service Company's territory. Fred L. Sanford, general manager for Sanford Service Co., said that no company-operated service station program was contemplated.

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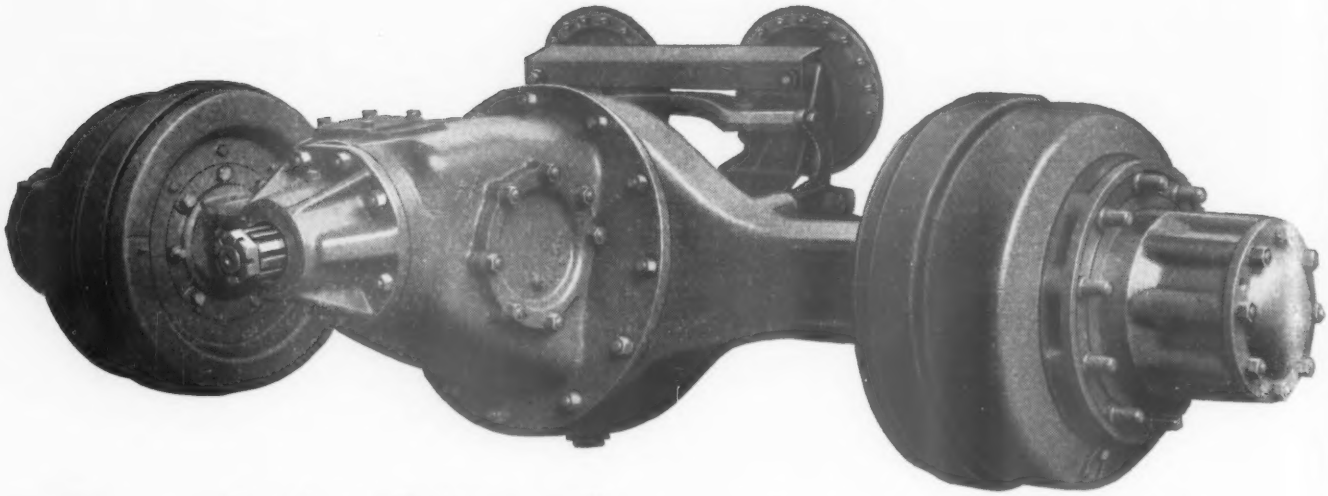

New S&U 200 Series

Single-Speed Double-Reduction*

New hypoid-helical double-reduction drive . . . new torsion-flow "Axaloy" axle shafts . . . new 9-16 tooth combination differential . . . new interjacent pinion shaft location . . . plus scores of other modern features. Data on ALUMINUM housing, brake shoes and hubs on S Series for weight saving available upon request.

READY NOW!
TWO NEW HEAVY-DUTY AXLES!

Two new tough-as-nails Timken axles are ready to help you whip your heavy-duty hauling problems—the new S and U-200 Single-Speed Double-Reduction Axles and the new S and U-300 2-Speed Double-Reduction Axles.

Both are designed for modern high-power engines—the S Series for loads over 18,000 pounds, and the U Series for heavier loads and off-the-road operation. Both are bears for punishment—have more up-to-the-minute features than you can shake a prop shaft at. Both are in *full production now*—the only postwar heavy-duty axles ready to pitch in and start working for you immediately.

Operators who are using these new axles call them the *final answer to heavy-duty final drive problems.* For all that's modern and best in design and performance, specify Timken S or U Series Axles under the next heavy-duty trucks you buy.

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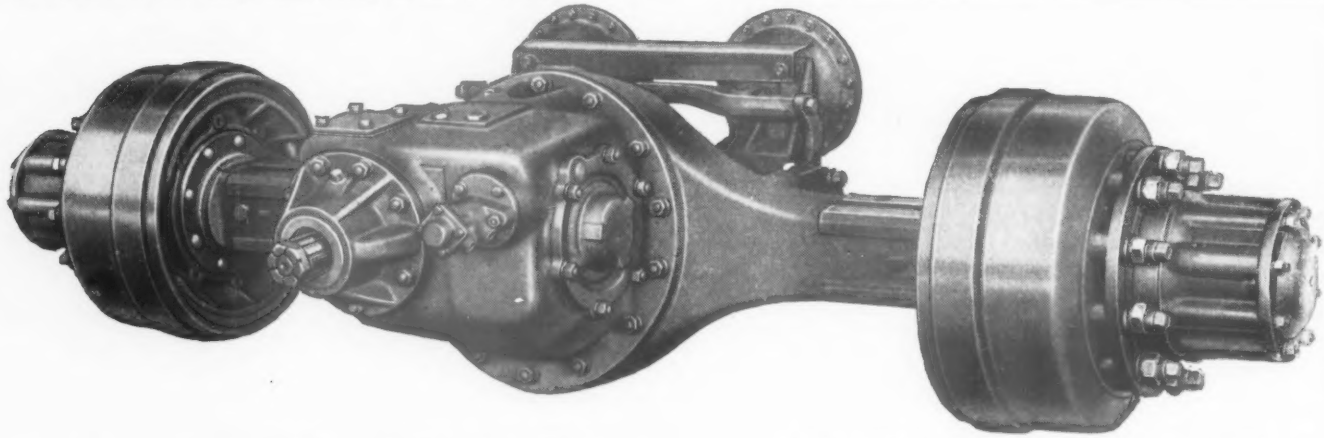

New S&U 300 Series

2-Speed Double-Reduction*

2-speed double-reduction drive doubles available gear combinations—gives greater pulling power and high road speeds in same truck. Equipped with famous Timken Easy Power Shift—no manual shifting required. Like S and U-200, S and U-300 offer option of new DP Heavy-Duty Hydraulic Brake or famous P Series Power Brake.

*** FINAL DRIVES INTERCHANGEABLE IN THE SAME AXLE HOUSING**

Compact Commission's First Statistical Report Compiled; Permanent Program Awaits Final OK

By E. G. Dahlgren

Technical Secretary

Interstate Oil Compact Commission

The Interstate Oil Compact Commission has recently released a statistical report showing data on oil, gas, and natural gas production, drilling operations, drilling permits, data on crude oil stocks, refining operations, and gasoline consumption.

This report is an experimental one prepared in accordance with authorization made by the Compact's Executive Committee at its Oklahoma City meeting in January, 1946.

The authorization permitted the Compact Commission staff to spend a limited amound of money in experimental reports, prior to a final decision on the proposed statistical program at the Tulsa spring quarterly meeting April 11, 12 and 13.

For several years it has been recommended that the Interstate Oil Compact Commission prepare and distribute full and complete statistical data in connection with all phases of the producing and other branches of the petroleum industry throughout the nation, in order to promote a more effective program of conservation.

During the war period, the Production Division of the Petroleum Administration for War prepared monthly reports, illustrated with tables and charts, which showed various aspects of production, and included information on drilling operations, exploratory activities and maximum efficient rates of production. Since the dissolution of PAW, these reports have been discontinued

The Independent Petroleum Assn. of America, at the meeting of its board of directors in Shreveport, La., in January, recommended that the Interstate Oil Compact Commission carry on the statistical program of PAW and the Petroleum Industry War Council.

It has also been recommended for sometime that the reports on production and related activities distributed by the various state oil and gas regulatory agencies be analyzed and coordinated by the Interstate Oil Compact Commission in a national report.

The first experimental report was submitted to the Executive Committee of the commission at its meeting in Oklahoma City March 9. The report contained data on oil and gas production by states for the month of December, 1945, and the year, 1945. The natural gas production data was the first attempt by any agency to assemble this data on a monthly basis. The Bureau of Mines publishes a Natural Gas Chapter annually which is published in the Minerals Yearbook. It has been suggested for some time that efforts be made to assemble natural gas data in a manner comparable with oil production. Several states are not equipped to assemble oil and gas production data on a monthly basis, and efforts are being made to provide this type of information either by state agencies or by oil and gas associations.

The second experimental report will be released at the Tulsa quarterly meeting, beginning April 11. Information is being assembled for the month of January, 1946. Every effort is being made to assemble the information through existing state oil and gas state agencies. No effort is being made to assemble the data directly from the industry.

The first report was illustrated with charts showing United States crude oil production, crude oil stocks, Texas crudes and stocks of origin, index numbers of average wholesale prices, United States imports of crude oil, and United States crude runs to stills.

Questionnaires Sent Out

At the direction of the Compact's Executive Committee, questionnaires are being sent to everyone on its mailing list and oil and gas trade associations, in order to get the views of everyone regarding the advisability of the continuation of the proposed statistical program.

Three questions are asked in the questionnaire form. The first question requests an expression whether or not the proposed program should be carried on. In the second question, an expression is desired regarding co-operation in furnishing data. The third question requests an expression as to whether increased contributions from the states should be made in order to care for the necessary additional expense.

Practically all of the oil and gas regulatory agencies approve this program. Comments of officials in states which are not members of the Compact Commission indicate general approval of the proposed program. C. W. Deming, director, Georgia Oil and Gas Commission, made this comment, "We are most heartily in favor of the Compact Commission's assuming the gathering and promulgation of data." With Indiana data, A. C. Colby, assistant to the state geologist, said, "We hope the information submitted is of value, and assure you of our co-operation." Edward L. Clark, Missouri state geologist, enthusiastically endorsed the program when he wrote, "I am heartily in favor of the Interstate Oil Compact Commission's taking over the work that had been formerly handled by the federal government. You can certainly count on us to supply you with all the data that is possible." Paul S. Mathes, commissioner, Tennessee Department of Conservation, makes the following statement, "We believe that in the near future we will see a considerable increase in drilling activity. With this increase in mnd we will appreciate the opportunity to co-operate with the commission by supplying from time to time all data which is available."

In conjunction with the commission's program of keeping posted on economic trends in the oil and gas industries, the organization has enlisted some of the nation's top-ranking economists. The economics committee, originally composed of three members, has been revised and enlarged. Committee members are:

R. J. Gonzalez, chairman, Humble Oil and Refining Co., Houston; J. H. Salmon, Shell Oil Co., New York; John Boatwright, Standard Oil Co. of Indiana, Chicago; James V. Brown, Independent Petroleum Assn. of American, Washington; A. J. McIntosh, Socony-Vacuum Oil Co., New York; H. J. Struth, Texas Mid-Continent Oil & Gas Assn., Dallas; Sidney A. Swensrud, Standard Oil Co. (Ohio), Cleveland; Fred Van Covern, American Petroleum Institute, New York, and Clarel B. Mapes, Mid-Continent Oil & Gas Assn., Tulsa.

Councillors of the committee are: Alexander Sachs, New York; Joseph E. Pogue, Chase National Bank, New York; E. DeGolyer, DeGolyer and MacNaughton, Dallas, and Stewart P. Coleman, Standard Oil Co. of New Jersey, New York.

Sohio Plans to Construct $1,500,000 Technical Center

NPN News Bureau

CLEVELAND—A $1,500,000 technical center combining all of company's research and technical services will be built here at suburban Warrensville Heights by Standard Oil Co. (Ohio).

Construction will start as soon as building restrictions and availability of materials permit. Research and development building, in an 84 acre tract, will be modernistic and set back from the road "like a college campus." Present research is carried on at a laboratory in conjunction with Western Reserve University and in company's refineries.

W. T. Holliday, Sohio president, said this technical center, which follows present petroleum research construction trends, would result in many economies by reason of combining all research and technical activities.

North Carolina Jobbers to Meet

Special to NPN

RALEIGH, N. C.—North Carolina Oil Jobbers Assn. will hold a spring meeting in Wilson at the Hotel Cherry on April 11 at 12 noon.

The meeting is primarily for jobbers who live in and east of Durham, but others throughout the state have been invited to attend.

Among subjects scheduled for discussion are: pump, tank and other equipment supply questions affecting jobbers; the kerosine and fuel oil supply for curing tobacco and other matters of interest to jobbers.

OPA Finally Grants 10-Cent Crude Boost Effective April 1; IPAA Protests Delay

NPN News Bureau

WASHINGTON — OPA picked All Fools' Day to announce its long-awaited 10-cent crude price increase, and representatives of the independent producer immediately suggested that perhaps the agency was "merely observing the April 1 tradition," in view of what IPAA General Counsel Russell B. Brown termed the "proved necessity" of at least a 35c per bbl. raise.

While OPA was cutting the red tape —and costing the producers $1,320,000, Mr. Brown pointed out, by the three-day delay—Chairman Patman (D., Tex.) of House Small Business Committee, renewed his demand for "immediate lifting of price controls on crude oil and refined products."

Committee Studies Bill

The House Banking and Currency Committee began executive sessions to determine what sort of a price control extension bill it would report, after Price Administrator Paul Porter said he "assumed" gasoline would be eligible for price decontrol if it could be separated from other petroleum products, on which there was "intense pressure" at the present time.

Although Rep. Patman and Rep. Crawford (R., Mich.), both members of the Banking and Currency committee, have urged consistently that oil price controls be removed, there was no indication whether their suggestions would be followed.

OPA's announcement said it had been planned to make the crude price boost effective March 29, but that "the first day of the month was found to be preferable because of customary accounting practices in the industry and the confusion in records which would result from a price change occurring directly before the month's end."

Call Reason "Phoney"

IPAA immediately retorted that the reason was a "phoney" one, and that it had no support in industry custom or practice. The effect, IPAA said, is to deprive the producers of $440,000 per day, since increases in product prices already have been made and consumers were absorbing the 10c crude oil advance even before it was in effect.

"The OPA tells us that the first of April is more suited to the convenience of the purchasers," Mr. Brown said. "There are few of them compared to the number of producers. The convenience, and especially the necessities of the producers, are not being considered. They have never been, in the nearly five years that OPA has controlled prices. The producer was put in the deep freeze in the middle of 1941.

"The producers and the American people are entitled to know which purchasers—if any—had the superior weight with OPA to beat the producers out of three days of the price advance, calculating from March 29 when OPA said the increase would be made effective.

"No more perfect illustration of the arbitrary, unreasoning and repressive attitude of OPA on crude oil prices can be found than this decision to hold back three days of the price increase."

Sees Trend to Monopoly

Rep. Patman told Mr. Porter in a letter that continuation of price controls on crude oil "can only serve to encourage the trend toward monopoly in crude petroleum production which became so apparent during the war."

He pointed out that 40% of the nation's crude oil is produced by approximately 19,000 small operators "who never have had the benefit of profitable sideline operations in the refining and marketing fields."

Remarking that the House Small Business Committee had studied the oil price situation very carefully throughout the war from the standpoint of small producers, Patman said he felt the time had come "to give these small firms the release from controls which they so definitely deserve."

As criticism of OPA continued to mount, the agency announced plans to go ahead with studies to determine if refiners could absorb the full 10c crude price advance and if the 10-cent boost was sufficient to bring producers up to 1938-39 earnings standard.

Until that is determined, effect on refiners and marketers will be uncertain. Producers, however, contend that refiners got price advance and passed it to consumers before the crude increase went into effect. Probability is that OPA will be forced to boost prices all along the line, if it does not get out of price control business altogether and let competition lower prices.

OPA Advisory Committee Seeks Operational Data from Refiners

NPN News Bureau

CLEVELAND — Four hundred questionnaires are being mailed to refiners by the Office of Price Administration's National Refiners' Industry Advisory Committee to obtain information as to whether earnings of the refining industry are below the 1936-39 standard, or will be as result of 10c per bbl. crude increase. Questionnaires are to be returned direct to OPA.

In memorandum accompanying the questionnaire, signed by C. L. Henderson, chairman, and S. A. Swensrud, vice chairman, refiners are told OPA has indicated it will make adjustments in refined product price ceilings if the refining industry can show that its earnings under present conditions, taking into consideration the increase in the ceiling price of crude oil of 10c per bbl. are not in accord with the earnings level of refinery operations during the base period of 1936 through 1939.

In addition to a complete report of refinery operations, separate memorandum has been requested regarding general wage increases, shift differentials, fringe adjustment, payrolls, overtime situation, change in salaries, and information through 1947 as to estimated refinery output, percentage yield of major products, and percentage by which the various cost items in the questionnaire will be increased or decreased as compared with fourth quarter of 1945.

Texas Commission Tells Navy More Oil Can Be Had if OPA Is Persuaded to Increase Prices

Special to NPN

MIDLAND, Tex. — Texas Railroad Commission has indicated it will turn a deaf ear to all increased allowable proposals until the Navy, War Shipping Administration and Office of War Mobilization persuade OPA to do something about prices and lift restrictions.

Commissioners Beauford Jester and Olin Culberson are agreed on this stand but Commissioner Ernest O. Thompson has expressed a dissenting note, warning that refusal to raise Texas crude allowables to meet Navy demands may give the federal administration an excuse to re-activate PAW and resume issuing directives and allocations on oil.

After listening to arguments of representatives of the three Washington departments, Commissioners Jester and Culberson took the position that the Navy and other agencies could have their oil if they would persuade OPA to act. The Washington representatives asked an allowable increase of 200,000 b/d.

Capt. B. B. Briggs, who with other representatives flew here to make their plea, told the hearing that the Navy needs 270,000 b/d of Navy special fuel oil and at present is being offered only 144,064. The remainder is coming out of Navy stocks, he said, and Navy has only 10-day supply on East Coast. Ships have been tied up at New York, Philadelphia and other ports due to lack of fuel.

Maury Wells of WSA said his agency's need for fuel is so great that it has had to borrow oil from the Navy, and said shipments of food to Europe are being held up for lack of oil. Ships are tied up with the empty tanks at Pensacola, New York, Norfolk, Philadelphia, Houston and Galveston, he said.

Commissioner Jester said the Navy's plight is no fault of the Texas Commission or Texas producers.

"If you will see that Texas producers get the long-awaited 58-cent per bbl. increase, and that this is the last order of OPA which would then release its control on crude oil, then I will give thorough consideration to the request," he stated.

NATIONAL OIL HEAT EXPOSITION and CONVENTION

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"a get-together that means all-together for a new day in oil heat"

An OPEN LETTER to the Oil Heating Industry from the President of OHI

Gentlemen:

The Oil Heating Industry owes a debt of gratitude to Exhibitors in the forthcoming National Oil Heat Exposition. They have made the Industry's first post-war show the greatest of all Oil Heating Expositions so successfully sponsored by Oil-Heat Institute of America.

This display of confidence in the future of our vital industry has been exhibited in the face of difficult reconversion problems. It is a stirring tribute to the calibre of the men and women in this Industry and is a happy augury as we enter an era of peace, a new day for Oil Heat, a period of great expansion.

The mission of OHI is to increase public knowledge and acceptance of Oil Heat. OHI accepts the mandate given it to make the Exposition and Annual Convention, held along with the Exposition, further the welfare of the Industry as a whole.

OHI's Annual Convention—its Retail Sales, "The Industry Looks at Itself" and Engineering Sessions, its Annual Banquet-Dance, its good-fellowship, and its many other opportunities for discussion of Oil Heating—is dedicated to this purpose: The welfare of the entire Oil Heating Industry.

So, as sponsor and host, OHI extends to all—to manufacturers of Oil Heating Equipment and Accessories, to Dealers, to Oil and other Allied Industries, and to their ladies—to the whole Industry-Family, whether Exhibitors or not, whether OHI members or not—a cordial invitation to join in this GET-TOGETHER that means ALL-TOGETHER for the Oil Heating Industry.

OHI especially invites you to bring your wives that they may enjoy a visit to historic Philadelphia and environs. There will be a special Ladies' Day program on Wednesday, April 24. The ladies will not want to miss the famous entertainers and name band at the Banquet and the dancing that follows.

We'll see you in Philadelphia, April 23-27.

Sincerely yours,

W. A. MacPherson

President

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Committee To Study More Data On Motor Fuel Specifications

WASHINGTON — Federal Specifications Committee on Lubricants and Liquid Fuels April 1 discussed plans to explore possibility of amending motor fuel M specifications to permit use of solvent additive but otherwise was "pretty well set" on specs as drafted.

Question of sulfur content, it appeared, will be held in abeyance for some time, committee being of opinion it doesn't have enough data to warrant action now. Also, group noted with interest that Canada, on March 15, brought its maximum back to .15% after letting it go to .25.

Special to NPN

MEXICO CITY—Petroleos Mexicanos has announced 15c increase, effective March 26, in its posted prices for Bunker "C" fuel, ships' bunkers, at Mexican ports on the Pacific Coast. New Price is $1.65 per bbl. at Guaymas, Acapulco, Manzanillo, and Salina Cruz. Price at Mazatlan unchanged at $1.50.

Contracts for Products Pipeline

NPN News Bureau

COLUMBUS, O. — Contract was awarded March 28 to Oklahoma Contracting Co., Dallas, Tex., for construction of 6-in. products pipeline from Toledo to Columbus and from Toledo to Detroit by pipeline headquarters of Sinclair Refining Co. here.

Line will cost approximately $2,500,000. Deliveries have started on approximately 170 miles of pipe already contracted for. Work is expected to start immediately.

° ° °

NEW YORK — Sinclair Oil Corp. has completed arrangements for connecting company's Kansas City refinery to Great Lakes Pipe Line System. At present, only Sand Springs, Okla., and Coffeyville, Kan., refineries of company are connected to this system.

When Kansas City plant is connected, it is expected that about 30% of its gasoline output will be moved through line instead of by rail.

Michigan Crude Runs Decrease

LANSING — Oil & Gas Assn., of Michigan reports daily average crude runs for the state as 43,774 bbls., or a total of 1,225,684 bbls. for February. This represents a 12% decline from January.

Deaths

A. R. Taylor, 44, recently appointed assistant engineering director of Chek-Chart Corp., died March 27. Before his emplyoment with Chek-Chart, Mr. Taylor was with the Maintenance Division, Office of Chief of Ordnance, Washington, D. C. as a civilian engineer.

For many years prior to his connection with the War Department he was assistant to chief lubrication engineer of Sinclair Refining Co.

Oil Markets

MIDWESTERN—Gasoline prices were unchanged the past week and consensus of most refiners was that prices showed some firmness. A few refiners reported improvement in volume of regular-grade gasoline sales one stating that his sales in Wisconsin, Iowa, North and South Dakota had showed noticeable increase. Marketers, on the other hand, reported a sluggish gasoline market the entire week. Marketers' prices were unchanged with 78-80 oct. Ethyl quoted at 5.125 to 5.75c and 73-75 oct. regular at 4.375 to 5.125c, F.O.B. Group 3.

Kerosine and range oil demand dropped off, but all spot offerings were taken at ceiling prices, according to reports. One large marketer of light fuel oils stated that demand was one-third of normal for the season because of unusually warm weather. Marketers opinions varied as to whether kerosine and range oil prices would hold at ceiling through June. One stated that large buyers would keep prices firm while another said that continual decline in demand will ease prices. Refiners who had been behind on kerosine and range oil orders by 200 cars at the beginning of March expected to enter April "all caught up." This refiner thought that partially responsible for the slackening in light oil demand was either belief or hope among some marketers and jobbers that OPA might still remove last January's 0.5c increase on April 30th "despite official word to the contrary."

Residual oil continued in short supply with demand heavy throughout the week.

° ° °

CENTRAL MICHIGAN—Prices remained unchanged with refiners reporting some slight improvement in regular-grade and straight-run gasoline.

Demand for distillate oils slowed somewhat toward the end of the past week, but refiners said inventories remained at low levels. One refiner stated that he had begun to push sales of kerosine and range oil because storage was converted to gasoline over a month ago and it will be some time before gasoline demand will empty those tanks. "Wisconsin tax laws are hindering sales of kerosine and range oil at this time because quantity in storage as of May 1 determines the amount of tax to be paid", he said, adding that "buyers are holding off until after that date."

Michigan refiners stated that inventories of residual oil ranged from "operating on daily production" to low. General opinion was that short supply of this product would continue indefinitely.

° ° °

GULF COAST—Trading was moderately active in the cargo market at the Gulf the past week, with both export and domestic buyers showing more interest in making commitments than for some weeks. Prices generally were reported unchanged.

Interest centered on gasoline and heavy fuels—on the former because some buyers believed "the market" was on bottom, on the latter because of their continued scarcity and the fact that demand remained far in excess of supply.

Sale of two cargoes of 78 oct. leaded gasoline at 5.25c per gal., F.O.B. the Gulf, was disclosed early in the week. One cargo is for prompt (April 3rd) lifting, and one for May lifting, both to a domestic buyer. Unleaded grades also came in for some play. Export buyer was in the market late in the week for a cargo of 65 oct. unleaded, and was offering 4.875c per gal. firm. Other buyers also appeared interested in "taking as much 60 oct. unleaded as is available at 4.625c." No sales of the unleaded grades had been disclosed up to the end of the week.

The Argentine inquiry for aviation gasoline (See NPN of March 27) was said to have been withdrawn without explanation. Reports the past week, however, indicated that another South American buyer would be in the market for aviation gasoline in the near future.

Foreign buyers showed some interest in kerosine and gas oils while the call from domestic buyers had subsided considerably. No. 2 fuel was said to be

CRUDE PRICES

Since changes in crude oil prices are few, the two pages of crude oil price tables are printed only when there are sufficient changes to warrant.

A record is kept in the Cleveland office of NPN and OILGRAM from which the publishers will be glad to make proofs, or letters or affidavits as to what the prices are, and without charge to regular subscribers.

Effective April 1, the Office of Price Administration authorized a general price increase of 10c per barrel for crude oil in all fields throughout the country. Companies buying oil made the new prices effective at once, and NPN, at time of going to press, had received many notices of such increases.

A complete tabulation of the new prices will be published as soon as all are available. In the meantime, correct crude oil buying prices may be known, with a few possible exceptions, by adding 10c to quotations printed by NPN in its March 27 issue.

Crude Price Changes

For latest table of crude prices published, see NPN March 27, pages 60, 61 and 63.

rather freely available, while kerosine and gas oils were more closely held.

Heavy fuels remained tight, and there was no indication that the recent 21c increase in prices was bringing out greater offerings. "Everybody still wants the residual oils," one supplier commented.

ATLANTIC COAST—Quotations for all products for the most part were unchanged in Atlantic Seaboard districts the last week in March. Increased gasoline shipments were reported by some suppliers, while volume on kerosine and light fuels slackened. Heavy fuels remained tight.

Spring weather stimulated gasoline shipments in the northern seaboard districts and "firming of gasoline" was indictated in reports late in the week. Buyers in some instances said there was less tendency on the part of suppliers "to shade prices." Reports early in the week had indicated there was considerable shading of posted prices in southern seaboard districts as well as the northern areas.

Kerosine still was comparatively closely held by suppliers despite the drop in shipments. Increased offerings of the light fuels, particularly No. 2 at New York harbor, were taken by some sources as indicating that inventories were accumulating "a bit more rapidly than had been anticipated."

No easing of supply of heavy fuels was apparent, with demand from industrial users as well as from ships' bunkers far in excess of offerings.

WESTERN PENNA.—Status of all products was unchanged in western Penna., according to reports of refiners in the field the last week in March. Prices also were reported unchanged although there was said to be some shading of gasoline quotations in the lower field.

Refiners and buyers were unanimous in indicating a continued tight market for lubricating oils, petrolatums and wax. The market was "flooded with inquiries" according to most refiners. "The situation is getting worse, rather than better," said one buyer, who added: "There's a tremendous shortage of petrolatum and wax, regardless of grade. Green petrolatum is as scarce as the white grades. There's just nothing available to buy."

Slight improvement in gasoline shipments was reported by some refiners but at the same time the product remained freely available. There's plenty of gasoline around, and the market is still weak," one refiner commented.

Demand for kerosine and light fuels continued moderately active. Some refiners said they were beginning to get caught up on shipments for the first time since last fall.

MIDCONTINENT — Flat prices of $1.23 and $1.18 for No. 6 fuel resulted in Kansas and East Texas, respectively the past week when last refiner quoting the low in each of the two markets reported advancing his price 21c in accordance with new OPA ceilings. Following day No. 6 fuel went up 14c on the low in Oklahoma when refiner who had been quoting 97c reported advancing his quotation; quotations reported by Oklahoma refiners ranged from $1.11 to $1.18.

Gasoline and tractor fuel demand increased steadily over the past week, according to refiners throughout the Midcontinent area. Several said they had been able to increase tractor fuel production since demand for No. 2 fuel has dropped. Kerosine demand for use in brooders has picked up in Kansas. No surplus of distillates was indicated in any Midcontinent area.

Oklahoma refiner withdrew his 6c quotation on regular-grade gasoline March 29, saying he had none to offer on the open spot market. Prevailing price range of 5 to 6c was not affected.

Sale of five cars of 42-44 W. W. kerosine to a jobber at 4.875c FOB Group 3, for shipment during April in buyer's cars was reported by an East Texas refiner.

Seven cars of grade 26-70 natural gasoline were reported sold open spot at 2.75c FOB Group 3 during the week. No open spot sales were reported FOB Breckenridge; sellers quoted 2.25c.

Summary of Daily Gasoline Prices (March 25 to April 1)

U. S. Motor (ASTM octane)	Monday April 1	Friday March 29	Thursday March 28	Wednesday March 27	Tuesday March 26
78-80 octane Ethyl:					
Oklahoma	5.75 - 6.75	5.75 - 6.75	5.75 - 6.75	5.75 - 6.75	5.75 - 6.75
Mid-Western (Group 3 basis)	5.75 - 6.75	5.75 - 6.75	5.75 - 6.75	5.75 - 6.75	5.75 - 6.75
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	7	7	7	7	7
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	7	7	7	7	7
E. Tex. (Truck Tnsp.)	7	7	7	7	7
73-75 octane:					
Oklahoma	5 - 6	5 - 6	5 - 6	5 - 6	5 - 6
Mid-Western (Group 3 basis)	5 - 6	5 - 6	5 - 6	5 - 6	5 - 6
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	6	6	6	6	6
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	6	6	6	6	6
E. Tex. (Truck Tnsp.)	6	6	6	6	6
63-66 octane:					
Oklahoma	5.125(1)	5.125(1)	5.125(1)	5.125(1)	5.125(1
Mid-Western (Group 3 basis)	5.125(1)	5.125(1)	5.125(1)	5.125(1)	5.125(1)
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.625(1)	5.625(1)	5.625(1)	5.625(1)	5.625(1)
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.625(2)	5.625(2)	5.625(2)	5.625(2)	5.625(2)
E. Tex. (Truck Tnsp.)	....	....	....	....	....
60 octane & below:					
Oklahoma	4.75 - 5.25	4.75 - 5.25	4.75 - 5.25	4.75 - 5.25	4.75 - 5.25
Mid-Western (Group 3 basis)	4.75 - 5.25	4.75 - 5.25	4.75 - 5.25	4.75 - 5.25	4.75 - 5.25
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.25	5.25	5.25	5.25	5.25
E. Tex. (Truck Tnsp.)	5.25	5.25	5.25	5.25	5.25
Motor Gasoline, 80-83 oct. (Ethyl)					
New York harbor	8 -8.95	8 - 8.95	8 - 8.95	8 -8.95	8 -8.95
New York harbor, barges	7.9(2)	7.9 (2)	7.9(2)	7.9(2)	7.9(2)
Philadelphia	8 - 8.95	8 -8.95	8 - 8.95	8 - 8.95	8 - 8.95
Philadelphia, barges	7.9(2)	7.9(2)	7.9(2)	7.9(2)	7.9(2)
Baltimore	7.25 - 8.7	7.25 - 8.7	7.25 - 8.7	7.25 - 8.7	7.25 - 8.7
Baltimore, barges	7.15-7.4(2)	7.15-7.4(2)	7.15-7.4(2)	7.15-7.4(2)	7.15-7.4(2)
Motor Gasoline, 76-79 oct.					
New York harbor	7 - 8	7 - 8	7 - 8	7 - 8	7 - 8
New York harbor, barges	6.9 - 7.6	6.9 - 7.6	6.9 - 7.6	6.9 - 7.6	6.9 - 7.6
Philadelphia	7 - 7.7	7 - 7.7	7 - 7.7	7 - 7.7	7 - 7.7
Philadelphia, barges	6.9(2)	6.9(2)	6.9(2)	6.9(2)	6.9(2)
Baltimore	6.25 - 7.45	6.25 - 7.45	6.25 - 7.45	6.25 - 7.45	6.25 - 7.45
Baltimore, barges	6.15(2)	6.15(2)	6.15(2)	6.15(2)	6.15(2)
Motor Gasoline:					
Western Penna. Bradford-Warren:					
74 Oct.	7 -7.25(2)	7 -7.25(2)	7 -7.25(2)	7 -7.25(2)	7-7.25(2)
Western Penna. Other Districts:					
74 Oct.	6.75 - 7.25	6.75 - 7.25	6.75 - 7.25	6.75 - 7.25	6.75 - 7.25

Note: Gasoline prices are as reported in each day's Platt's OILGRAM Daily Oil Price Service.

OIL PRICE SECTION ★ At Refineries and Terminals and by Tank Wagon

Prices herewith are reproduced from Platt's *OILGRAM* Daily Oil Price Service, associated with National Petroleum News, whose representatives in all *NPN-OILGRAM* offices devote their time exclusively to reporting oil industry prices everywhere.

Prices shown are actual sales prices, or quotations meaning sellers' general offers or posted prices; for current sales and shipment; for the business day or period stated; except Tank Wagon prices, prices are for bulk lots such as tank car and motor transport; barge or tanker cargo lot prices are identified; FOB refineries or terminals; in cents per gal. except where shown in bbls. of 42 gals.; ex all fees and taxes; for crude oil and its products lawfully produced and transported; reported as received by *OILGRAM* and National Petroleum News but not guaranteed; for subscribers' private use only and not for resale or distribution or publication. For further details of price conditions apply to any *NPN-OILGRAM* office or see back of any *OILGRAM* Price Service invoice.

For complete price service delivered daily from nearest *OILGRAM* publishing office, New York, Cleveland and Tulsa, address Platt's Price Service, Inc., 1213 W. 3rd St., Cleveland (13), Ohio. Annual subscription rate payable in advance $100 per year train mail and $112.50 per year air mail.

Refinery Prices

Gasoline —U. S. Motor (ASTM octane except where otherwise specified)

Prices in Effect	April 1	Mar. 25
OKLAHOMA		
78-80 oct. Ethyl	5.75 – 6.75	5. 75– 6.75
73-75 oct.	5 – 6	5 – 6
63-66 oct.	5.125(1)	5.125(1)
60 oct. & below.	4.75 – 5.25	4.75 – 5.25
MID-WESTERN (Group 3 basis)		
78-80 oct. Ethyl.	5.75 – 6.75	5.75 – 6.75
73-75 oct.	5 – 6	5. – 6
63-66 oct.	5.125(1)	5.125(1)
60 oct. & below.	4.75 – 5.25	4.75 – 5.25
N. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
78-80 oct. Ethyl.	7	7
73-75 oct.	6	6
63-66 oct.	5.625(1)	5.625(1)
60 oct. & below.	5.2 – 5.25	5.2 – 5.25
W. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
78-80 oct. Ethyl.	7	7
73-75 oct.	6	6
63-66 oct.	5.625(2)	5.625(2)
60 oct. & below.	5.25	5.25
E. TEX. (Truck Tnspt.)		
78-80 oct.	7	7
73-75 oct'	6	6
60 oct. & below.	5.25	5.25
CENT. W. TEX. (Prices to truck transports)		
78-80 oct.	7 (2)	7 (2)
73-75 oct.	6 (2)	6 (2)
60 oct. & below.	5.25 (2)	5.25(2)
KANSAS (For Kansas destinations only)		
78-80 oct. Ethyl.	6.625– 7.3	6.625– 7.3
63-66 oct.	5.625– 6.3	5.625– 6.3
63-66 oct.	5.6(1)	5.6(1)
60 oct. & below..	5.125– 5.5	5.125– 5.5
ARK. (For shipment to Ark. & La.)		
78-80 oct. Ethyl.	6.625(1)	6.625(1)
73-75 oct.	5.625(1)	5.625(1)
60 oct. & below. unleaded	5 (1)	5 (1)
WESTERN PENNA.		
Bradford-Warren:		
74 oct.	7 –7.25(2)	7 –7.25 (2)
Other districts:		
74 oct.	6.75 – 7.25	6.75 – 7.25

Prices in Effect	April 1	March 25
CENTRAL MICHIGAN (FOB Central Mich. refinery group basis; for shpt. within Mich.; shpts. may originate at plants outside Central group.)		
U.S. Motor:		
78-80 oct.	8 –9.25	8 –9.25
73-75 oct.	7 –8.25	7 –8.25
Str. run gasoline, excluding Detroit shpt.	5 – 6	5 – 6
OHIO (S. O. Ohio quotations for statewide delivery and subject to exceptions for local price disturbances.)		
73-75 oct.	8	8
CALIFORNIA		
80-82 oct. (Ethyl).	8 – 8.5	8 – 8.5
74-75 oct.	7 – 7.5	7 – 7.5

Kerosine, Gas & Fuel Oils

OKLAHOMA		
41-43 grav. w.w.	4.875	4.875
42-44 grav. w.w.	5	5
Range Oil	4.5	4.5
No. 1 p.w.	4.375	4.375
No. 1 straw	4.25 (1)	4.25 (1)
No. 2 straw	4.125	4.125
No. 3 fuel	4	4
No. 6 fuel	$1.11–$1.18	$0.97–$1.18
14-16 fuel	$1.18(1)	$1.18
MID-WESTERN (Group 3 basis)		
41-43 grav. w.w.	4.875	4.875
41-44 grav. w.w.	5	5
Range Oil	4.5	4.5
No. 1 p.w.	4.375	4.375
No. 2 straw	4.125	4.125
No. 3	4	4
No. 6	$1.11–$1.18	$1.11–$1.18
N. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
41-43 grav. w.w.	4.875	4.875
42-44 grav. w.w.	5 (1)	5 (1)
No. 1 p.w.	4.375(1)	4.375(1)
No. 6 fuel	$1.18(2)	$1.18(2)
W. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
No. 6 fuel	$1.18(1)	$1.18(1)
E. TEX. (Truck trnspt.)		
41-43 grav. w.w.	4.875	4.875
Tractor fuel	4.875– 5	4.875– 5
Range oil	4.5 (1)	4.5 (1)
No. 1 p.w.	4.375(1)	4.375(1)
45 Cet. Diesel	4.75 (1)	4.75 (1)
No. 2 straw	4 –4.125(2)	4 –4.125(2)
58 D.I. & above	4.75 (1)	4.75 (1)
No. 6 fuel	$1.18(a)	$1.18
U.G.I. gas oil	3.5 (1)	3.5 (1)

(a) This price effective March 25 Shown incorrectly in NPN of March 27.

AMARILLO, TEX. (For shpt. to W. Okla. & Tex. differential territory.)		
42-44 grav. w.w.	5 (1)	5 (1)
KANSAS (For Kansas destinations only).		
42-44 grav. w.w.	5.2	5.2
No. 1 p.w.	4.6	4.6
No. 6 fuel	$1.23(a)	$1.23

(a) This price effective March 25. Shown incorrectly in NPN of March 27.

ARK. (For shipment to Ark. and La.)		
42-44 w.w. kero.	5 (1)	5 (1)
No. 2	4.125(1)	4.125(1)
No. 3 fuel	4 (1)	4 (1)
Tractor fuel	5.625(1)	5.625(1)
Diesel fuel 52 & below	4.5 (1)	4.5 (1)
Diesel fuel 58 & above	4.75 (1)	4.75 (1)
WESTERN PENNA.		
Bradford-Warren:		
45 grav. w.w.	6.55	6.55
No. 2 "	6.25(1)	6.25(1)
No. 3 "	6.25(1)	6.25(1)
36-40 gravity	6.25(2)	6.25(2)
Other districts:		
45 grav. w.w.	6.925	6.925
47 grav. w.w.	7.05(2)	7.05(2)
No. 1 fuel	6.675–6.925	6.675–6.925
No. 2 "	6.25 – 6.375	6.25 – 6.375
No. 3 "	6.25 – 6.375	6.25 – 6.375
36-40 grav.	5.75 – 6.375	5.75 – 6.375

Prices in Effect	April 1	March 25
CENTRAL MICHIGAN (FOB Central Mich. refinery group basis for shpt. within Mich.; shpts. may originate at plants outside Central group.)		
44-46 kerosine	6.25(1)	6.25(1)
46-49 gravity w.w.	6.3 – 6.5	6.3 – 6.5
P.W. Distillate	6	6
No. 2 light straw	5.75 (1)	5.75 (1)
No. 3 gas oil, Straw	5.5	5.5
U.G.I. gas oil	5	5
Fuel Oils (*Vis. at* 100).		
300-500 Vis.	4.14 – 4.64	4.14 – 4.64
100-300 Vis.	4.5 – 5	4.5 – 5
OHIO (S. O. Ohio quotations for statewide delivery)		
Kerosine	7.5	7.5
CALIFORNIA		
40-43 grav. w.w.		
San Joaquin Valley:		
Heavy fuel	$1.25	$1.25
Light fuel	$1.35	$1.35 (a)
Diesel fuel	4.75	4.75
Stove dist.	5.75	5.75
Los Angeles:		
Heavy Fuel	$1.25	$1.25
Light fuel	$1.35	$1.35 (a)
Diesel fuel	4 – 4.75	4 – 4.75
Stove dist.	5.75	5.75
San Francisco:		
Heavy fuel	$1.30	$1.30
Light fuel	$1.40	$1.40 (a)
Diesel fuel	5.25	5.25
Stove dist.	6.25	6.25

NOTE: All above heavy fuels meet Pacific specification 400; light fuel, spec. 300; Diesel fuels, spec. 200; and stove distillate, spec. 100.

(a) Correct for March 25; shown incorrectly in NPN of March 27.

Lubricating Oils

Prices in Effect	April 1	March 25
WESTERN PENNA.		

Prices are for sales made, or offers reliably reported, to jobbers & compounders only.

Viscous Neutrals—*No. 3 col. Vis. at* 70°*F.*

200 Vis. (180 at 100°) 420-425 fl.		
0 p.t.	38 (1)	38 (1)
10 p.t.	37 (1)	37 (1)
15 p.t.	36 (1)	36 (1)
25 p.t.	28–33	28–33
150 Vis. (143 at 100°) 400-405 fl.		
0 p.t.	36 (1)	36 (1)
10 p.t.	35 (1)	35 (1)
15 p.t.	34 (1)	34 (1)
25 p.t.	26–31	26–31

NOTE: Limited quantity neutrals available to regular trade.

Cylinder Stocks:

Brl. stk., 145-155 *vis. at* 210°, 540-550 fl., *No. 3 col.*		
10 p.t.	30.5 (1)	30.5 (1)
15 p.t.	29.5 (1)	29.5 (1)
25 p.t.	25	25
600 S.R. filterable	15	15
650 S.R.	15.5	15.5
600 fl.	16	16
630 fl.	17	17
MID-CONTINENT (F. o. b. Tulsa)		
Neutral Oils (*Vis. at* 100° *F. 0 to* 10 *P.P.*)		
Pale Oils:		
Vis. Color		
60-85—No. 2	7.5 – 8	7.5
86-110—No. 2	7.5 –8.5 (2)	7.5(2)
150—No. 3	11 –12	11 –11.5
180—No. 3	11.5–15	11.5–15
200—No. 3	12 –15	12 –15
250—No. 3	14 –16.5	14 –16.5
280—No. 3	15 –16	15
300—No. 3	16 –17 (2)	16 (2)
Red Oils:		
180—No. 5	11.5 (1)	11.5 (1)
200—No. 5	12 (1)	12 (1)
300—No. 5	16 –17.5(2)	16 –17.5 (2)
Bright Stock—*Vis. at* 210°		
200 Vis. D	27 (1)	27 (1)
150-160 Vis. D:		
0 to 10 p.p.	23	23
10 to 25 p.p.	22.5–23	22.5–23
25 to 40 p.p.	23 (1)	23 (1)
150-160 Vis. E	22 (1)	22 (1)
120 Vis. D:		
0 to 10 p.p.	22 (2)	22 (2)
600 S.R. Dark Green	8.5 (1)	8.5 (1)
600 S.R. Olive Green	10-11(2)	10-11 (2)
SOUTH TEXAS (Neutral Oils)		
Pale Oils (*Vis. at* 100° *F.*)		
Vis. Color		
100 No. 1½-2½	6.5	6.5
200 No. 2-3	8.75	8.75
300 No. 2-3	9.25	9.25
500 No. 2½-3½	10	10
750 No. 3-4	10.25	10.25
1200 No. 3-4	10.375	10.375
2000 No. 4	10.5	10.5

(Continued on next page)

NOTE—Parenthetical figures after prices indicate number of companies quoting when less than three companies are quoting.

Refinery Prices—Continued

Prices in Effect	April 1	March 25
Red Oils:		
100 No. 5-6	6.5 (2)	6.5 (2)
200 No. 5-6	8.75	8.75
300 No. 5-6	9.25	9.25
500 No. 5-6	10	10
750 No. 5-6	10.25	10.25
1200 No. 5-6	10.375	10.375
2000 No. 5-6	10.5	10.5

CHICAGO (From Mid-Continent p.l. crude). Neutral oils *vis. at* 100° *F.* 0 *to* 10 *p.p.*

Pale Oils: Vis Color		
60-85—No. 2	9 (1)	9 (1)
86-100—No. 2	9.25(1)	9.25(1)
150—No. 3	12.5(1)	12.5(1)
180—No. 3	13(1)	13(1)
200—No. 3	13(1)	13(1)
250—No. 3	14(1)	14(1)
Red Oils:		
180—No. 5	13(1)	13(1)
200—No. 5	13(1)	13(1)
250—No. 5	14(1)	14(1)
280—No. 5	15(1)	15(1)
300—No. 5	15.5(1)	15.5(1)

Note: Viscous oils, 15 to 30 p.p. are quoted 0.5c lower; 60-85 and 86-110 No. 2 non-viscous oils, 15 to 30 p.p., 0.25c lower.

Unfiltered Steam Refined (*Viscosity at* 210°)		
140	11.5(1)	11.5(1)
160	12.5(1)	12.5(1)
200	13.5(1)	13.5(1)
Bright stocks, 160 *vis. at* 210 *No.* 8 *color:*		
0 to 10 p.p.	24(1)	24(1)
15 to 25 p.p.	23.5(1)	23.5(1)
30 to 40 p.p.	21.5(1)	21.5(1)
E filtered Cyl. Stock	15.5(1)	15.5(1)

Note: To obtain prices delivered in Chicago add 0.25c per gal.

Natural Gasoline

(Group 3 & Breckenridge prices are to blenders on freight basis shown below. Shipments may originate in any Mid-Continent manufacturing district.)

FOB GROUP 3		
Grade 26-70	2.75 (Sale)	2.75 (Sale)
FOB BRECKENRIDGE		
Grade 26-70	2.25(Quotes)	2.25 (Quotes)
CALIFORNIA (FOB plants in Los Angeles basin)		
21-21.9 pound vapor pressure for blending	4.71–4.85(1)	4.71–4.85 (1)

Naphtha and Solvent

(*FOB Group* 3)		
Stoddard solvent	6.5 – 6.625	6.5 –6.625
Cleaners' naphtha	7.125	7.125
V.M.&P. naphtha	7.1 –7.125	7.1 – 7.125
Mineral spirits	6.1 – 6.125	6.1 – 6.125
Rubber solvent	7.1 – 7.125	7.1 – 7.125
Lacquer diluent	7.375– 8.125	7.375– 8.125
Benzol Diluent	7.875– 8.625	7.875– 8.625
WESTERN PENNA.		
Other Districts:		
Untreated naphtha	7 –7.25(2)	7 –7.25(2)
Stoddard solvent	7.25 – 7.5	7.25 – 7.5
OHIO (S. O. quotations for statewide delivery:) V.M.&P. naphtha. D.C. naphtha, Varnolene &		
Sohio solvent	9.5	9.5
Rubber solvent	9	9
E. TEXAS (Truck Tnspt.)		
Stoddard Solvent.	7(2)	7(2)

Wax

WESTERN PENNA. (Bbls. C.L.)		
White Crude Scale:		
122-124 A.m.p.	4.25(2)	4.25(2)
124-126 A.m.p.	4.25	4.25
MID-CONTINENT (C.L. FOB Refinery)		
Semi-refined:		
132-134 AMP, bbls.	5.25(1)	5.25(1)

CHICAGO (FOB Chicago district refinery of one refiner, in bags, carloads. Carloads, slabs loose, 0.4c less. Melting points are EMP (ASTM) methods; add 3° to convert into AMP.)

Fully refined:		
122-124 (bags only)	5.6	5.6
125-127	6	6
127-129	6.25	6.25
130-132	6.55	6.55
132-134	6.8	6.8
135-137	7.55	7.55

Petrolatums

WESTERN PENNA. (Bbls., carloads; tank cars, 0.5c per lb. less.)

Snow White	6.5 –7.125	6.5 – 7.125
Lily White	5.75 –6.375	5.75 – 6.375
Cream White	5 –5.875	5 – 5.875
Light Amber	3.375–4	3.375– 4
Amber	3.5 –3.75	3.5 – 3.75
Red	3.5 –3.625(2)	3.5–3.625(2)

Tank Wagon Prices

Commercial or consumer tank car, tank wagon, dealer, and service station prices for gasoline **do not include** *taxes; they do, however, include inspection fees as shown in general footnote. Gasoline taxes, shown in separate column, include 1.5c federal, and state taxes; also city and county taxes as indicated in footnotes. Kerosine tank wagon prices also do not include taxes; kerosine taxes where levied are indicated in footnotes. Dealer discounts are shown in footnotes. These prices in effect April 1, 1946 as posted by principal marketing companies at their headquarters offices, but subject to later correction.*

ATLANTIC REFINING

	Atlantic White Flash (*Regular Grade*) Commercial T.W.	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
Philadelphia, Pa	8.7	9.2	5.5	11.25
Pittsburgh	9.5	10	5.5	11.6
Allentown	9	9.5	5.5	11.6
Erie	9.5	10	5.5	11.6
Scranton	9.5	10	5.5	11.6
Altoona	9.5	10	5.5	11.6
Emporium	9.5	10	5.5	11.6
Indiana	9.5	10	5.5	11.6
Uniontown	9.5	10	5.5	11.6
Harrisburg	9	9.5	5.5	11.6
Williamsport	9.5	10	5.5	11.6
Dover, Del.	...	9.7	5.5	11.6
Wilmington, Del.	...	9.2	5.5	11.1
Boston, Mass.	...	9.6	4.5	....
Springfield, Mass.	...	10.4	4.5	....
Worcester, Mass.	...	9.8	4.5	....
Fall River, Mass.	...	9.5	4.5	....
Hartford, Conn.	...	9.9	4.5	....
New Haven, Conn.	...	9.5	4.5	....
Providence, R. I.	...	9.5	4.5	....
Atlantic City, N. J.	...	9.2	4.5	9.0
Camden, N. J.	...	9.2	4.5	9.0
Trenton, N. J.	...	9.2	4.5	9.0
Annapolis, Md.	...	9.55	5.5	9.8
Baltimore, Md.	...	8.95	5.5	8.8
Hagerstown, Md.	...	10.05	5.5	9.3
Richmond, Va.	...	9.5	6.5	11.3
Wilmington, N. C.	...	9.8	7.5	10.9
Brunswick, Ga.	...	9.5	7.5	*10.1
Jacksonville, Fla.	...	9.5	8.5	11.1

	Mineral Spirits T.W.†	V.M.&P. T.W.†
Philadelphia, Pa.	11	12.5
Lancaster, Pa.	12	13.5
Pittsburgh, Pa.	12.5	13.5

FUEL OILS—T.W.	1	2	3	5	6
Phila., Pa.	9.1	8.0	8.0	5.65	4.94
Allentown, Pa.	9.6	8.3	8.3	....	....
Wilmington, Del.	9.1	8.0	8.0	....	....
Springfield, Mass.	...	8.4	8.4	....	....
Worcester, Mass.	...	8.4	8.4	....	....
Hartford, Conn.	...	8.2	8.2	....	....

*Does not include 1c Georgia kerosine tax.

†Mineral Spirits prices also apply to Stoddard Solvent; V.M.&P. prices also apply to Light Cleaners Naphtha.

Discounts:

Gasoline—to undivided dealers, 0.5c off dealer t.w. except Georgia & Florida dealer t.w. and undivided dealer t.w. prices are same.

Kerosine—Thru Penna. & Delaware, 2c off t.w. price on t.w. deliveries of 25 gals. or more at one time.

CONT'L OIL

	Conoco N-tane (regular) †Tank Wagon	Demand (3rd Grade) Wagon	Gasoline Taxes	Kerosine T.W.
Denver, Col.	10	9	5.5	°10.5
Grand Junc., Col.	12.5	11.5	5.5	°13
Pueblo, Col.	9.5	8.5	5.5	°10
Casper, Wyo.	11.5	10.5	5.5	°12.5
Cheyenne, Wyo.	10	9	5.5	°9.5
Billings, Mont.	12	11	6.5	°13
Butte, Mont.	11.5	10.5	6.5	°14
Great Falls, Mont.	12	11	6.5	°13
Helena, Mont.	12	11	6.5	°13.5
Salt Lake City, Utah	13.5	12.5	5.5	°15
Twin Falls, Ida.	14.5	13.5	7.5	°17.5
Albuquerque, N. M.	10.5	9.5	*7	10
Roswell, N. M.	10	9	*7	7.5
Santa Fe, N. M.	10.5	9.5	*7.5	10.5
Ft. Smith, Ark.	9	6.25	8	8.5
Texarkana, Ark.	8.7	7.2	*5.5	7.5
Muskogee, Okla.	7.75	6.75	9	8.5
Oklahoma City, Okla.	8	7	9	8.5
Tulsa, Okla.	8	7	9	8.5

*Taxes: In gasoline tax column are included these city taxes—Albuquerque, & Roswell, 0.5c, Santa Fe, 1c. Texas 4c state tax applies within city limits of Texarkana, Ark.

†To consumers & Dealers

° Effective March 21; shown incorrectly in NPN of March 27.

HUMBLE OIL

	Humble (*Regular*) *Tank Wagon	Retail	Thriftane (*3rd Grade*) *Tank Wagon	Retail	Gasoline Taxes
Dallas, Tex.	*7.5	10.5	*6.5	8.5	5.5
Ft. Worth, Tex.	*7.5	10.5	*6.5	8.5	5.5
Houston, Tex.	8.5	12.5	7.5	10.5	5.5
San Ant., Tex.	8.5	12.5	7.5	10.5	5.5

*Consumer t.w. prices are 1c per gal higher than dealer t.w. prices shown above.

	Kerosine *Tank Wagon	Retail
Dallas, Tex.	7.5	10.5
Ft. Worth, Tex.	7.5	11.5
Houston, Tex.	8.5	11.5
San Antonio, Tex.	7.5	10.5

*To all classes of dealers & consumers.

Canada

PRICES OF IMPERIAL OIL, LTD.

Per Imperial Gallon, which is 1.2 U. S. Gallons

IMPERIAL OIL

	3-Star Imperial Gasoline (*Regular Grade*) †Gasoline T.W.	*Gasoline Taxes	Kerosine T.W.
Hamilton, Ont.	16.5	11	18
Toronto, Ont.	16.5	11	18
Brandon, Man.	21.5	10	°23.5
Winnipeg, Man.	20.9	10	22
Regina, Sask.	19.5	11	°21.5
Saskatoon, Sask.	22.3	11	°24.3
Edmonton, Alta.	20.4	10	°22.4
Calgary, Alta.	17.5	10	°19.5
Vancouver, B. C.	15	10	24
Montreal, Que.	16.5	11	17.5
St. John, N. B.	16	13	19
Halifax, N. S.	16	13	19

*Includes 3c Federal, and Provincial taxes

†To divided & undivided dealers.

° Effective March 18; shown incorrectly in NPN of March 20 and 27.

SOCONY VACUUM

	Socony Mobilgas (*Regular Grade*) Com. Cons. T.W.	Undiv. Dlr. T.W.	Gasoline Taxes
New York City			
Manhattan & Bronx	8.5	9.0	*5.5
Kings & Queens	8.5	9.0	*5.5
Richmond	8.4	8.9	*5.5
Albany, N. Y.	8.4	8.9	5.5
Binghamton, N. Y.	9.6	10.1	5.5
Buffalo	8.7	9.2	5.5
Jamestown, N. Y.	9.2	9.7	5.5
Mt. Vernon, N. Y.	8.6	9.1	5.5
Plattsburg, N. Y.	9.6	10.1	5.5
Rochester, N. Y.	9.6	10.1	5.5
Syracuse, N. Y.	9.3	9.8	5.5
Bridgeport, Conn.	8.5	9.0	4.5
Danbury, Conn.	9.0	9.5	4.5
Hartford, Conn	8.9	9.4	4.5
New Haven, Conn.	8.5	9.0	4.5
Bangor, Me.	9.5	10.0	5.5
Portland, Me.	9.0	9.5	5.5
Boston, Mass.	8.6	9.1	4.5
Concord, N. H.	10.0	10.5	5.5
Lancaster, N. H.	10.6	11.1	5.5
Manchester, N. H.	9.7	10.2	5.5
Providence, R. I.	8.5	9.0	4.5
Burlington, Vt.	9.5	10.0	5.5
Rutland, Vt.	9.5	10.0	5.5

	Mineral Spirits T.W.	V.M.&P T.W.
Buffalo, N. Y.	10.9	12.1
New York City	11	12
Rochester, N. Y.	11.8	13.1
Syracuse, N. Y.	12.2	....
Boston, Mass.	12	13
Bridgeport, Conn.	†16.3	†17.3
Hartford, Conn.	†16.3	†17.3
Providence, R. I.	13	14

	Kerosine Yard	T.W.	Mobilfuel Diesel T.C.	T.W.	Mobilheat Fuel Yard	T.W.
New York City:						
Manhat'n & Bronx	6.5	9.3	...	8.3	6.1	8.0
Kings & Queens	6.5	9.3	...	8.3	6.1	8.0
Richmond	6.5	9.3	...	...	6.1	8.0
Albany	6.5	8.8	5.8	8.3	6.0	8.0
Binghamton	7.9	10.2	...	9.7	7.4	9.2
Buffalo	7.6	9.9	7.0	9.3	7.2	9.0
Jamestown	7.7	10.0	...	9.6	7.3	9.0
Mt. Vernon	6.6	9.3	...	8.4	6.2	8.0
Plattsburg	7.1	9.4	...	8.9	6.6	8.4
Rochester	7.7	10.0	6.9	9.2	6.9	8.7
Syracuse	7.5	9.8	6.8	9.1	6.8	8.6
Conn.:						
Bridgeport	6.8	9.3	...	8.5	6.3	8.0
Danbury	7.2	9.8	...	...	6.8	7.5
Hartford	7.0	9.5	...	8.5	6.4	8.2
New Haven	6.3	9.3	6.0	8.3	5.9	8.0
Maine:						
Bangor	6.9	9.3	6.4	8.7	6.4	8.1
Portland	6.5	9.2	5.8	8.3	6.0	8.0

Tank Wagon Prices—Continued

	Kerosine Yard	Kerosine T.W	Mobilfuel Diesel T.C.	Mobilfuel Diesel T.W.	Mobilheat Fuel Yard	Mobilheat Fuel T.W.
Mass.:						
Boston	6.8	9.6	5.8	8.3	6.2	8.1
N. H.:						
Concord	7.4	9.7	...	9.6	7.3	9.1
Lancaster	8.5	10.8	...	10.5	8.2	10.0
Manchester	7.5	10.1	...	9.3	7.0	8.8
R. I.:						
Providence	6.8	9.3	5.8	8.3	6.2	8.1
Vermont:						
Burlington	7.1	9.4	6.5	8.8	6.5	8.2
Rutland	7.3	9.6	...	9.0	6.7	8.5

*Does not include 1% city sales tax applicable to price of gasoline (ex tax).

†In steel barrels.

Discounts: Diesel—On t.w. deliveries, 0.5c for at least 400 gals.; 1c for full tank truck.

S. O. CAL.

	Chevron (*Regular*) T.T.	Chevron (*Regular*) Retail	Chevron Av. 73 T.T.	Gasoline Taxes	Kerosine T.T.
San Francisco, Cal.	10	14	12.5	4.5	12.25
Los Angeles, Cal.	9.5	13.5	12	4.5	10.75
Fresno, Cal.	11	15	13.5	4.5	13.25
Phoenix, Ariz.	12	16	14.5	6.5	13.25
Reno, Nev.	12	16	14.5	5.5	14.25
Portland, Ore.	10.5	14.5	13	6.5	14.25
Seattle, Wash.	10.5	14.5	13	6.5	14.25
Spokane, Wash.	12.5	16.5	16	6.5	17.25
Tacoma, Wash.	10.5	14.5	13	6.5	14.25
Boise, Ida.	13.5	17.5	18	7.5	°17

Resale and Commercial Gasoline:—Tank car deliveries of Chevron Aviation 73, and Chevron Gasoline .25c per gallon below posted net tank truck price. Pearl Oil (The Standard Kerosine):—Tank car deliveries 3c below posted tank truck price.

° Effective March 20; shown incorrectly in NPN of March 27.

S. O. IND.

	Red Crown (Reg Grade) Blue Crown (3rd Grade) Red Cr'n. Cons. T.W.	Red Cr'n. Dlr. T.W.	Blue Cr'n. Dlr. T.W.	Gasoline *Taxes	Kerosine T.W
Chicago, Ill.	11.6	9.6	9.1	4.5	11.1
Decatur, Ill.	11.3	9.6	8.7	4.5	10.8
Joliet, Ill.	11.6	10.1	9.2	4.5	11.1
Peoria, Ill.	11.4	9.9	9.4	4.5	10.9
Indianapolis, Ind.	11.3	9.8	9.3	5.5	10.6
Evansville, Ind.	11.1	9.6	8.6	5.5	10.4
South Bend, Ind.	11.7	10.2	9.7	5.5	11.0
Detroit, Mich.	11.1	9.6	...	4.5	10.5
Grand Rapids, Mich.	11.1	9.6	...	4.5	10.4
Saginaw, Mich.	11.1	9.6	...	4.5	10.4
Green Bay, Wisc.	11.9	10.4	9.9	5.5	11.4
Milwaukee, Wis.	11.8	10.3	9.8	5.5	11.3
La Crosse, Wis.	11.6	10.1	9.6	5.5	11.1
Minneapolis - St. Paul.	11.6	10.1	9.6	5.5	11.1
Duluth, Minn.	11.9	10.4	...	5.5	11.4
Mankato, Minn.	11.6	10.1	9.6	5.5	11.1
Des Moines, Ia.	11.1	9.6	9.1	5.5	10.6
Mason City, Ia.	11.4	9.9	9.4	5.5	10.9
St. Louis, Mo.	11.0	9.5	9.1	4.5	10.6
Kansas City, Mo.	10.7	9.2	8.6	4.5	10.2
St. Joseph, Mo.	10.7	9.2	....	4.5	10.4
Fargo, N. D.	12.6	11.1	10.6	5.5	12.1
Huron, S. D.	12.0	10.5	10.0	5.5	11.5
Wichita, Kans.	9.5	8.6	7.2	5.5	9.5
Omaha, Neb.	11.1	9.6	9.1	6.5	10.6

Stanavo Ethyl Aviation Number 73

	Cons. T. W.	*Taxes
Detroit, Mich.	15.7	4.5
Fargo, N. D.	15.1	5.5
Huron, S. D.	14.5	5.5
Indianapolis, Ind.	14.2	5.5
Kansas City, Mo.	13.2	4.5

	Oleum Spirits	V.M.&P. Naphtha	Stanisol	*Taxes
(Prices are base prices before discounts)				
Chicago	13.5	13.8	12.8	4.5
Detroit	15.8	15	16.3	4.5
K. C., Mo.	13.3	14.3	13.8	1.5
St. Louis, Mo.	13.7	14.7	13.2	1.5
Milwaukee	14.4	15.4	14.9	5.5
Minneap'lis	14.2	15.2	13.5	5.5

Fuel Oils T.W. Chicago

	Standard Heater Oil	Stanolex Furnace Oil
1-99 gals.	9.8	9.3
100-149 gals.	8.8	8.3
150 gals. & over	8.3	...
150-399 gals.	...	8.3
400 gals. & over	...	7.8

	Stanolex Fuel A	Stanolex Fuel C
1-749 gals.	7.0	6.2
750 gals. & over	6.25	5.45

Stanolex Furnace Oil

Other Points	1-99 gals.	100 gals. & over
Indianapolis	9.5	8.5
Detroit	9.2	8.2
Milwaukee	9.5	8.5
Minneapolis	9.6	8.6
St. Louis	8.9	7.9
Kansas City	8.6	7.6

*Taxes: In gasoline tax column are included these city taxes—Kansas City, St. Joseph and St. Louis, 1c. Iowa kerosine prices are ex 4c state tax. In naphtha tax column are included 1.5c federal tax and state taxes. State sales, occupation, consumer and use taxes to be added where applicable.

S. O. KY.

Crown Gasoline (*Regular*)

	†Crown Net Dealer	Gasoline Taxes	Kerosine T.W.
Covington, Ky.	9.5	6.5	9.8
Lexington, Ky.	10.25	6.5	9.8
Louisville, Ky.	9.75	6.5	9.3
Paducah, Ky.	9.75	6.5	9.3
Jackson, Miss.	9.5	7.5	*9.5
Vicksburg, Miss.	9.25	7.5	*9.0
Birmingham, Ala.	9.75	*8.5	9.5
Mobile, Ala.	9	*9.5	9.0
Montgomery, Ala.	10.00	*9.5	*10.5
Atlanta, Ga.	10.25	7.5	*11.1
Augusta, Ga.	10.25	7.5	*10.6
Macon, Ga.	10.25	7.5	*11.1
Savannah, Ga.	9.5	7.5	*10.1
Jacksonville, Fla.	9.5	8.5	9.1
Miami, Fla.	9.5	8.5	9.1
Pensacola, Fla.	9	*9.5	8.5
Tampa, Fla.	9.5	8.5	9.1

*Taxes: In tax column are included these city and county gasoline taxes: Mobile, 2c city; Birmingham, 1c city, Montgomery, 1c city and 1c county; Pensacola, 1c city. Georgia and Montgomery, Ala. have 1c kerosine tax, Mississippi 0.5c, included in above prices.

†Consumer t.w. prices are same as net dealer prices.

S. O. N. J.

Esso (*Regular Grade*)

	Consumer Tank Wagon	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
Atlantic City, N. J.	8.70	9.20	4.5	9.0
Newark	8.70	9.20	4.5	9.0
Annapolis, Md.	9.05	9.55	5.5	...
Baltimore	8.45	8.95	5.5	8.8
Cumberland	9.85	10.35	5.5	10.3
Washington, D. C.	8.70	9.20	4.5	9.3
Danville, Va.	9.60	10.10	6.5	9.7
Petersburg	9.25	9.75	6.5	9.3
Norfolk	8.70	9.20	6.5	9.0
Richmond	9.00	9.50	6.5	9.3
Roanoke	10.20	10.70	6.5	10.0
Charleston, W. Va.	10.30	10.80	6.5	11.1
Parkersburg	10.30	10.80	6.5	10.8
Wheeling	10.05	10.55	6.5	11.4
Charlotte, N. C.	9.80	10.30	7.5	9.6
Hickory	10.20	10.70	7.5	10.6
Mt. Airy	10.40	10.90	7.5	9.8
Raleigh	10.10	10.60	7.5	10.6
Salisbury	9.90	10.40	7.5	11.0
Charleston, S. C.	9.20	9.70	7.5	...
Columbia	10.10	10.60	7.5	...
Spartanburg	9.60	10.10	7.5	...
New Orleans, La.	8.45	8.95	8.5	*7.5
Baton Rouge	8.45	8.95	8.5	*8.0
Alexandria	8.45	8.95	8.5	*8.0
Lake Charles	8.70	9.20	8.5	*9.5
Shreveport	8.20	8.70	8.5	*6.5
New Iberia, La.	8.70	9.20	8.5	*7.5
Knoxville, Tenn.	9.95	10.45	8.5	11.0
Memphis	8.90	9.40	8.5	9.0
Chattanooga	9.70	10.20	8.5	9.5
Nashville	10.20	10.70	8.5	8.5
Bristol	9.45	9.95	8.5	10.5
Little Rock, Ark.	9.20	9.70	8.0	10.5

	Mineral Spirits T.W.	V.M.&P. T.W.
Newark, N. J.	13	14.5
Baltimore, Md.	15.5	....
Washington, D. C.	15.5	....

Fuel Oils—T.W.	No. 1	No. 2
Atlantic City, N. J.	9.0	8.0
Newark	9.0	8.0
Baltimore, Md.	8.8	8.0
Washington, D. C.	9.3	8.4
Norfolk, Va.	9.0	7.8
Petersburg	9.3	8.0
Richmond	9.3	8.0
Charlotte, N. C.	9.6	9.4
Hickory	...	9.0
Raleigh	10.6	9.1
Charleston, S. C.	...	8.0
Columbia	...	9.0
Spartanburg	...	9.8

*Does not include 1c Louisiana kerosine tax.

Discounts:

Esso gasoline—to undivided dealers, 0.5c off dealer t.w.

Kerosine—In South Carolina 1c per gal. off posted t.w. price for 25 gals. or more. In Arkansas 2c per gal. off posted t.w. price.

Naphtha—To buyers taking following quantities at one time: Newark, 2c per gal. on 200 gals. or more, less than 200 gals. 0.5c higher price; Baltimore, 2c off on 25 to 100 gals. and 3c on over 100 gals.; Washington, 2c off to contract buyers.

S. O. OHIO

Sohio X-70 Gasoline (*Regular Grade*)**

	Consumer T.W.	Resellers	Gasoline °S.S. Taxes	†Kerosine T.W.
Ohio, Statewide	††12	10	13.5 5.5	9.8
Akron	12	9.5	12.5 5.5	9.8
Canton	12	9.5	12.5 5.5	9.8
Cincinnati	12	9.5	12.5 5.5	9.8
Cleveland	12	9.5	12.5 5.5	9.8
Columbus	12	9.5	12.5 5.5	9.8
Dayton	12	9.5	12.5 5.5	9.8
Lima	12	9.5	12.5 5.5	9.8
Mansfield	12	9.5	12.5 5.5	9.8
Marion	12	9.0	12.0 5.5	9.8
Portsmouth	12	9.5	12.5 5.5	9.8
Toledo	12	9.5	12.5 5.5	9.8
Youngstown	12	9.5	12.5 5.5	9.8
Zanesville	12	9.5	12.5 5.5	9.8

Aviation Gasoline—Statewide

	Consumer Gasoline T.W.	Taxes
Sohio Aviation Gasoline Clear Spec. AN-F-22, Amend. 1	14.5	5.5
Esso Ethyl Avia. Grade 73	15.5	5.5
Esso (Clear) Avia. Grade 80	16.5	5.5
Esso Aviation Grade 91/98	17.5	5.5
Esso Aviation Grade 100/130	20.5	5.5

†Naphtha—T.W.	Statewide
S. R. Solvent	13.5
D. C. Naphtha	14
V.M.&P. Naphtha	14
Varnolene	14
Sohio Solvent	14

Fuel Oils—T.W.	No. 1	No. 2	No. 3	No. 4
Ohio, Statewide	8.8	8.8	8.3	*8.05

**Renown (third-grade) prices are same as X-70 unless otherwise noted.

*Prices at company-operated stations.

†Kerosine prices are ex 1c state tax. Naphtha prices are ex 1.5c federal and 4c state tax.

††Statewide prices are subject to exceptions other than those shown

Discounts:

Esso aviation—on contract to hangar operators and resellers 2c off consumer t.w.

*For Cleveland area only. Full compartment hose dumps.

Fuel oils—Statewide prices are for t.w. & drum deliveries of 50 gals. or more; prices for deliveries of less than 50 gals. are 0.5c higher.

Naphthas—to contract consumers off t.w. prices—Statewide: 300 to 999 gals., 0.5c; 1000 to 2499 gals., 0.75c; 2500 to 4999 gals., 1c; 5000 or more gals. 1.5c. Lucas County: Less than 50 gals., tank wagon price, 50 to 249 gals., 0.5c; 250 to 499 gals., 1c; 500 gals. or over, 1.5c.

TEXAS CO.

	Gasoline—Dealer T.W. Fire-Chief (*Regular*)	Indian (*3rd Grade*)	Gasoline Taxes
Dallas, Tex.	7.5	6.5	5.5
Ft. Worth, Tex.	7.5	6.5	5.5
Wichita Falls, Tex.	8.5	7.5	5.5
Amarillo, Tex.	8.5	7.5	5.5
Tyler, Tex.	8.5	7.5	5.5
El Paso, Tex.	11	10.5	5.5
San Angelo, Tex.	8.5	7.5	5.5
Waco, Tex.	8.5*	7*	5.5
Austin, Tex.	8.5	7.5	5.5
Houston, Tex.	8.5	7.5	5.5
San Antonio, Tex.	8.5	7.5	5.5
Port Arthur, Tex.	8.5	7.5	5.5

*Less 1c temporary allowance to all dealers.

Notice

Tank Wagon prices include inspection fees on both gasoline and kerosine unless otherwise specified per gallon as follows:

Ala. 1/40c on gasoline; Ark. 1/20c; Fl. 1/8c; Ill. 3/100c; Ind. 2/25c; Kans. 1/50c; La. 1/32c; Minn. 7/200c; Neb. 2/100c; Nev. 1/20c; N. C. 1/4c; N. Da. 1/20c; Okla. 2/25c; S. Car. 1/8c; S. Da. 1/40c; Tenn. 2/5c; and Wisc. 3/100c.

Kerosine inspection fees only: Ala. 1/2c; Fla. 1/8c; Iowa 3/50c; Mich. 1/5c per gal.

Atlantic Coast

(Prices are of refiners, FOB their refineries and tanker terminals, and of tanker terminal operators FOB their terminals)—Prices in Effect April 1

Seaboard Export Coastwise Prices

	MOTOR GASOLINE (ASTM Octane)				KEROSINE & FUEL OILS				
District	74-75 Oct.	76-79 Oct.	80-83 Oct. (Ethyl)	Min. 83 Oct. (Ethyl)	KEROSINE &/OR NO. 1 FUEL	NO. 2 FUEL	NO. 3 FUEL	No. 5	No. 6
N. Y. Harb.	7(2)	7 – 8	8-8.95	8(1)	6.1	5.7	5.7 (1)	$1.90 (a)	$1.72
N. Y. Harb., barges	6.9(2)	6.9 – 7.6	7.9(2)	7.9(1)	6	5.6	5.6 (1)	....	....
Albany	7.1(1)	7.1 – 7.8	8.1(1)	9.3(1)	6.3	5.8	5.8 (1)	....	$1.92(1)
Philadelphia	7	7 – 7.7	8– 8.95	8(2)	6.2	5.7	5.7	$1.93	$1.72
Philadelphia barges	6.9(2)	6.9(2)	7.9(2)	7.9(2)	....	....	....	....	....
Baltimore	6.25–7	6.25–7.45	7.25–8.7	7.25-7.75(2)	6.2	5.7	5.7 (2)	$1.80(1)	$1.72
Baltimore barges	6.15(2)	6.15(2)	7.15-7.4 (2)	7.15-7.4 (2)	....	....	....	....	....
Norfolk	6.8(1)	6.8 – 7.1	7.8(1)	....	6.1	5.7	....	$1.76(1)	$1.68
Wilmington, N. C.	6.65(1)	6.65 – 7.35	7.65 (2)	....	6.05	5.7	....	....	....
Charleston	6.65(1)	6.65 – 7.05	7.65(2)	....	6.2	5.7	....	$1.71(1)	$1.63 (2)
Savannah	....	7 – 7.37	8(2)	....	6.06	5.25	5.25 (1)	....	$1.63 (1)
Jacksonville	....	7 – 7.375	8 – 8.375	....	6.05	5.25	....	....	$1.42-1.63(b)
Miami	....	7 – 7.375	8 – 8.375	....	6.05	5.25 (2)	....	....	....
Tampa	....	7 – 7.375	8 – 8.375	....	6.05	5.25	....	....	$1.49–$1.53
Pensacola	....	6.625–7(2)	....	....	5.3 (1)	5.25 (1)	....	....	....
Mobile	....	6.5–6.87(2)	....	....	5.25 (2)	....	....	....	....
New Orleans	5.7(1)	5.7–6(2)	6.45 (2)	....	4.625	4.25 (2)	....	$1.26(1)	$1.18
Portland	7.1(1)	7.1–7.9	8.1–9.15(2)	9.4(1)	6.3	5.8	5.8 (1)	$2.245 (1)	$1.765
Boston	7.1(2)	7.1 – 7.8	8.1–9.05	8.1–9.3(2)	6.2	5.8	5.8 (1)	$1.945	$1.765
Providence	7.1(1)	7.1 – 7.8	8.1–9.05(2)	9.3(1)	6.2	5.8	5.8 (1)	1.845(1)	$1.735
New Haven	....	....	....	....	....	....	....	....	$1.735(1)

(a) Price is for straight-run low pour test No. 5; three refineries quote $1.80 for high pour test No. 5.
(b) This price shown incorrectly in NPN of March 27.

	Bunker C Fuel Ships' bunkers (Ex Lighterage)	Diesel Oil Ships' bunkers (Ex Lighterage)	Diesel Oil Shore Plants	Gas House Gas Oil 28-34 Gravity
N. Y. Harbor	$1.72	$2.36	5.7 (1)	5.8 (2)
Albany	$1.92(1)	$2.52 (1)	5.8 (1)	6 (1)
Philadelphia	$1.72	$2.36	....	....
Baltimore	$1.72	$2.36 (2)	5.7 (1)	....
Norfolk	$1.68	$2.36 (2)	5.7 (1)	....
Charleston	$1.63(2)	$2.36 (2)	5.7 (1)	....
Savannah	$1.63 (1)	....	....	....
Jacksonville	$1.42–1.63(b)	$2.20 (1)	....	....
Tampa	$1.49–$1.53	....	....	....
New Orleans	$1.18	$1.86 (1)	....	....
Portland	$1.765	....	5.8 (1)	5.9 (1)
Boston	$1.765	$2.40 (1)	5.8 (2)	5.9 (1)
Providence	$1.735	$2.402 (2)	5.8 (1)	5.9 (1)
New Haven	....	....	....	....

Gulf Coast

Prices in Effect April 1

	New Orleans & Lower Mississippi to Baton Rouge Tank Cars	Barges	Texas Gulf Coast South of New Orleans Tank Cars	Barges	CARGOES Domestic & Export From all Gulf Ports
MOTOR GASOLINE					
Leaded (ASTM Oct.)					
80-83 Oct. Ethyl	6.325–6.45(2)	6.2–6.325(2)	....	6 –6.75	6 –6.75
76-79 Oct.	5.45– 6	5.45(2)	5.5–6(a)	5.25 – 5.75	5.25 – 5.75
74-75 Oct.	5.325(1)	5.325(1)	....	....	5.125– 5.25
70 Oct.	....	....	....	....	5 – 5.5
Unleaded (ASTM Oct.)					
70 Oct.	....	....	....	....	5.25 – 5.5
68 Oct.	....	....	....	....	5.25
65 Oct.	....	....	....	....	4.875– 5.25
60 Oct.	....	....	....	....	4.625
KEROSINE & LIGHT FUELS					
41-43 w.w. kero.	4.625	4.625	4.625	4.625	4.625
42-44 w.w. kero.	....	....	4.625	4.625	4.625
No. 2 fuel oil	4.25	4.25	4.25	4.25	4.25
DIESEL & GAS OILS (In diesel index No.)					
No. 5 fuel oil	$1.26	$1.26	$1.26	$1.26	$1.26
43-47 di.	....	....	....	....	4.5
48-52 di.	4.5	4.5	4.5	4.5	4.5
53-57 di.	4.625	4.625	4.625	4.625	4.625
58 and above	4.75	4.75	4.75	4.75	4.75

(a) One refiner quotes 5.75c for Dist. 1 shipment, 6c for other districts; one other refiner quotes 5.5 to 5.5c for unrestricted shipment.

NOTE: Above products in Truck Transports of 2,400 gal. and over 0.125c above Tank Car Prices.

HEAVY FUELS & BUNKER OIL (all Gulf Ports) Heavy Diesels	In Cargoes	In Ship's Bunkers (Ex Lighterage)
Below 28 API Grav.	....	$1.35 –$1.56
28 & above API Grav.	....	$1.86
Bunker C Oil	$1.18	$1.18

TANKER RATES

Approximate rates, cents per bbl.; Gulf-N. Atlantic, not east of New York

Heavy crude & fuel, 10-19.9 grav.	43.8
Light crude, 30 grav. or lighter	39
Gasoline	32.9
Kerosine	36
No. 2 fuel	38

Mid-Continent Lubes

(At Gulf; in packages, FAS. New Orleans; in bulk, FOB terminals).

Prices in Effect April 1

Bright Stock	Steel Drums	Bulk
D color, Vis at 210°		
150 vis., 0-10 p.p.	32.65 (1)	24.8 (1)

Pacific Coast

(In Ships' Bunkers, or Deep Tank Lots)

	Prices in Effect April 1 Diesel Fuel (P.S. 200)	Bunker C Fuel (P.S. 400)
San Pedro, Calif.	$1.765 (a)	$1.25
San Francisco, Calif.	1.815 (a)	1.30
Portland, Ore.	2.015 (a)	1.45
Seattle, Wash.	2.015 (a)	1.45

(a) This price correct March 25; shown incorrectly in NPN of March 27.

Wax

(Melting points are AMP, 3° higher than EMP. Prices are FOB refinery and do not include bag; freight or export differentials).

Prices in Effect April 1

Crude Scale	New Orleans Export	N. Y. Domestic	N. Y. Export
124-6 Yellow	4.25 (1)	....	4.25 (1)
122-4 White	....	4.25 (2)	4.25(2)
124-6 White	4.25 (1)	4.25	4.25
Fully Refined:			
123-5	5.2 (1)	5.2 (2)	5.2 (1)
125-7	5.2 (1)	5.2 (2)	5.2 (2)
128-30	5.6 (1)	5.6	5.6 (1)
130-32	5.85 (1)	5.85 (2)	5.85 (1)
133-5	6.15 (1)	6.15	6.15 (2)
135-7	6.4 (1)	6.4 (1)	6.4 (1)

Naphtha

Effective April 1

	V.M.&P. Naphtha	Mineral Spirits
New York Harbor.	11 (2)	10
Philadelphia	11 (2)	10
Baltimore	10.5 (2)	9.5
Boston	11.5 (2)	10.5
Providence	11.5 (1)	10.5 (2)

Export Prices

Prices in Effect April 1

	Mexican Gulf Ports U. S. Dollars per Bbl. Bunker C (Ships' Bunkers)	Diesel (Ships' Bunkers)
Tampico	$1.18	$1.86
Veracruz	1.18	....
Coatzacoalcos	1.18	1.86
	Pacific Coast	
Guaymas	$1.65	$3.22
Mazatlan	1.50	3.22
Acapulco	1.65	2.89
Manzanillo	1.65	2.89
Salina Cruz	1.65	2.89

Note: All bunkers sales subject to Mexican stamp tax of 1.65% ad valorem.

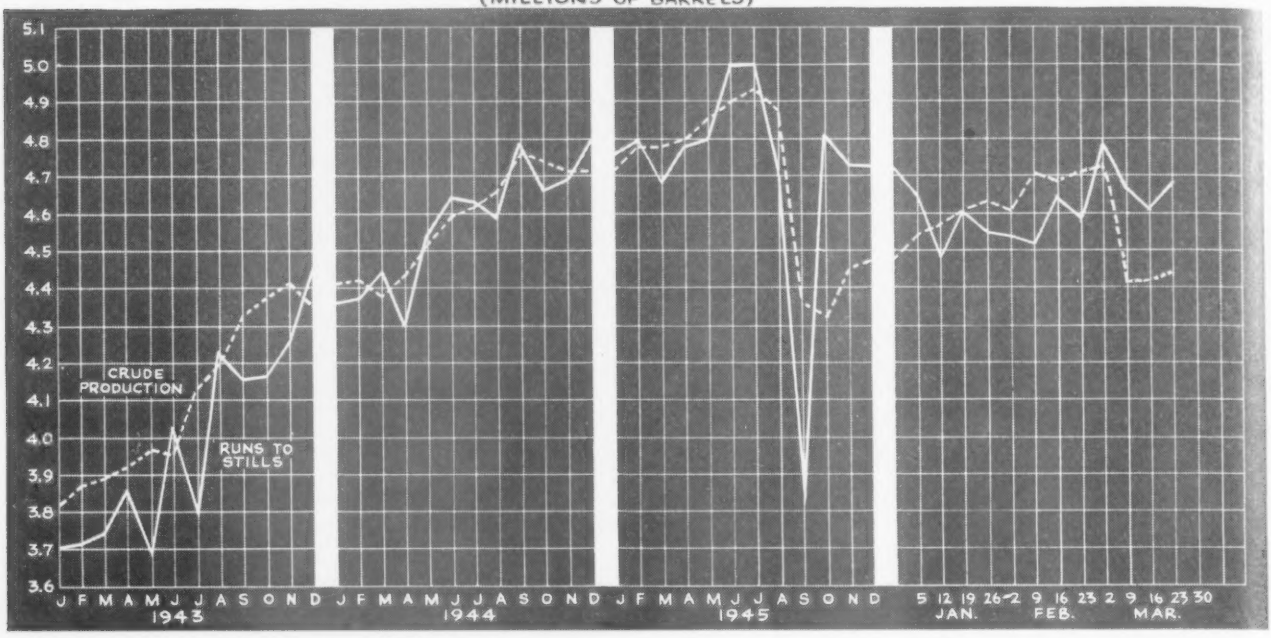
NPN Gasoline Index

	Dealer T.W.	Tank Car
	Cents Per Gal.	
April 1	9.75	6.14
Month ago	9.75	6.17
Year ago	10.39	6.72

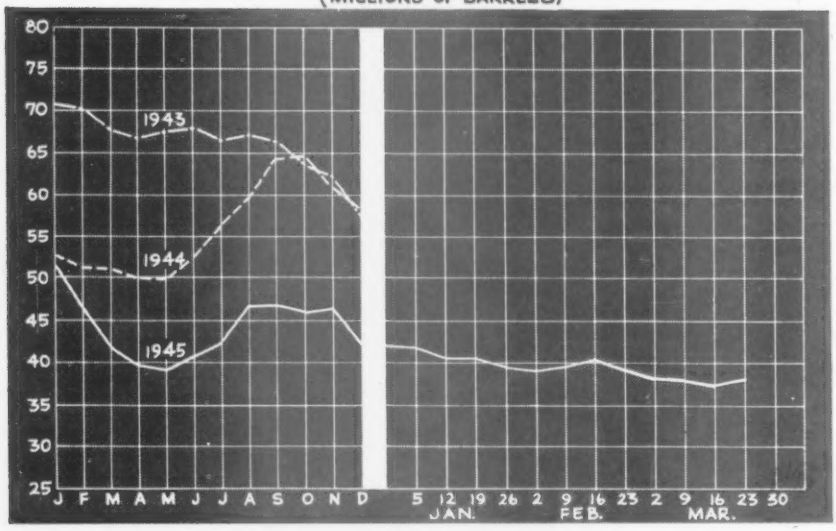
Dealer index is an average of "undivided" dealer prices, ex-tax, in 50 cities.

Tank car index is weighted average of following wholesale markets for regular-grade gasoline, FOB refineries or terminals: Okla., Mid-Western, W. Penna., Calif., N. Y. Harbor, Philadelphia, Jacksonville, Boston and Gulf Coast.

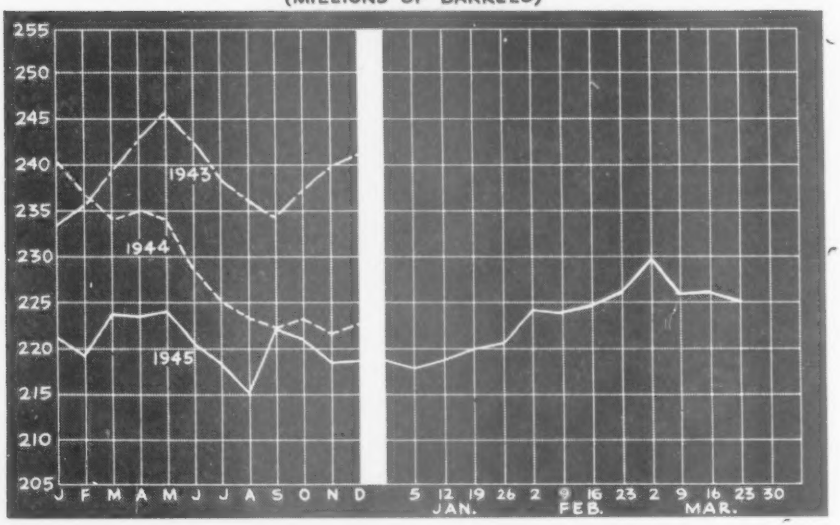
CRUDE PRODUCTION AND RUNS TO STILLS
(MILLIONS OF BARRELS)



RESIDUAL FUEL OIL STOCKS
(MILLIONS OF BARRELS)



CRUDE OIL STOCKS
(MILLIONS OF BARRELS)



Crude Petroleum & Petroleum Products

January 1946

(all figures in thousands of barrels)

	Jan. 1946 Total	Dec. 1945 Total	Jan. 1945 Total
TOTAL IMPORTS	12,806	9,919	6,923
Imports by Products			
Crude Petroleum	8,302	6,789	3,958
Motor Fuel	.....	....	141
Kerosine	.....	....	....
Distillate Fuel Oil	581	551	6
Residual Fuel Oil	3,878	2,579	2,773
Lubricating Oil	.....	....	....
Wax	.....	....	....
Asphalt	45	....	45
Unfinished Oils	.....	....	....
Total Refined	4,504	3,130	2,965

Prepared by the Independent Petroleum Assn. of America from data furnished by the Bureau of Census, U. S. Department of Commerce.

Crude Oil Stocks

(Bureau of Mines figures in thousands of bbls.)

	Mar. 16	Mar. 23	Change from Mar. 16
Penna. Grade	2,149	2,148	— 1
Other Appalachian	1,546	1,576	+ 30
Lima-Michigan	1,024	1,041	+ 17
Illinois-Indiana	18,069	18,477	+ 408
Arkansas	2,502	2,523	+ 21
Kansas	9.538	9,651	+ 113
Louisiana	11.443	11,777	+ 334
North	2,986	3,071	+ 85
Gulf Coast	8,457	8,706	+ 249
Mississippi	2,281	2,308	+ 27
New Mexico	5,653	5,714	+ 61
Oklahoma	35,953	35,821	— 132
Texas:	104,652	103,239	—1,413
East Texas	16,153	16,084	— 69
West Texas	35,543	35,238	— 305
Gulf Texas	27,596	26,928	— 668
Other Texas	25,360	24,989	— 371
Panhandle	4,689	4,530	— 159
North	6,262	6,291	+ 29
South	5,606	5,724	+ 118
Other	8,803	8,444	— 359
Rocky Mountain	7,989	7,981	— 8
California	19,983	19,985	+ 2
Foreign	3.451	2,912	— 539
Total gasoline-bearing in U. S.	226,233	225,153	—1,080
Heavy in California	4,473	4,413	— 60
Total located in Bureau of Mines East Coast district	13,680	13,268	— 412

REFINERY OPERATIONS

(American Petroleum Institute figures in thousands of barrels of 42 gallons each. Figures include reported totals plus estimate of unreported amounts and are therefore on a Bureau of Mines basis.)

Districts	Daily Average Crude Runs to Stills Week Ended		Gasoline Production at Refineries inc. Natural Blended Week Ended		Kerosine Production Week Ended		Gas Oil & Dist. Fuel Oil Production Week Ended		Residual Fuel Oil Production Week Ended	
	Mar. 23	Mar. 16	Mar. 23	Mar. 16	Mar. 23	Mar. 16	Mar. 23	Mar. 16	Mar. 23	Mar. 16
East Coast	756	763	1,774	1,587	378	293	1,032	1,170	1,557	1,619
Appalachian (Dist. 1)	94	92	342	320	62	65	79	66	64	66
Appalachian (Dist 2)	61	59	230	219	12	14	47	48	78	87
Ind. Ill. Ky.	718	751	2,345	2,562	331	390	561	734	1,028	999
Okla., Kans., Mo.	386	392	1,303	1,295	220	200	367	425	487	451
Inland Texas	224	203	851	873	110	112	94	101	410	364
Texas Gulf Coast	1,148	1,091	3,671	3,653	717	641	1,752	1,761	1,705	1,644
Louisiana Gulf Coast	312	301	818	837	330	268	524	454	282	288
No. La. & Arkansas	51	58	140	151	37	39	52	64	87	94
Rocky Mt. (Dist. 3)	14	14	46	44	6	6	10	12	34	33
Rocky Mt. (Dist. 4)	126	122	344	392	25	81	103	101	245	226
California	793	761	1,868	1,917	106	110	893	719	2,619	2,511
Total U. S.—B. of M. Basis	4,683	4,607	13,732	13,850	2,534	2,168	5,514	5,655	8,596	8,382
U. S.—B. of M. Basis, March 24, 1945	4,720		15,117		1,710		4,567		8,817	

Districts	Total Stocks Kerosine Week Ended		Total Stocks Gas Oil and Distillates Week Ended		Total Stocks Residual Fuel Oil Week Ended		Stocks of Finished and Unfinished Gasoline Week Ended		Per Cent Daily Refining Capacity Reported Week Ended	
	Mar. 23	Mar. 16	Mar 23	Mar. 16	Mar. 23	Mar. 16	Mar. 23	Mar. 16	Mar. 23	Mar. 16
East Coast	4,249	3,964	8,346	7,926	5,850	6,093	23,285	23,305	99.5	99.5
Appalacian (Dist. 1)	161	161	424	396	228	255	2,935	2,856	76.8	76.8
Appalachian (Dist. 2)	27	25	92	81	276	284	1,214	1,200	81.2	81.2
Ind., Ill., Ky.	1,246	1,129	3,098	3,100	3,151	3,043	24,072	24,213	87.2	87.2
Okla., Kans., Mo.	374	389	1,416	1,438	1,008	959	10,119	9,892	78.3	78.3
Inland Texas	320	292	297	300	636	629	3,132	3,091	59.8	59.8
Texas Gulf Coast	1,200	1,094	4,327	4,262	4,139	4,062	15,659	15,669	89.3	89.3
Louisiana Gulf Coast	487	499	1,348	1,189	1,157	1,179	4,351	4,427	96.8	86.8
N. La. and Arkansas	159	216	394	451	237	245	1,881	1,891	55.9	55.9
Rocky Mt. (Dist. 3)	20	20	34	31	33	33	111	105	17.1	17.1
Rocky Mt. (Dist. 4)	107	102	401	384	600	563	2,439	2,386	72.1	72.1
California	567	575	6,490	6,189	20,591	20,422	15,364	15,746	86.5	86.5
Total U. S.—B. of M. Basis	8,917	8,466	26,667	25,747	37,906	37,767	*104,562	104,781	85.7	85.7
U. S.—B. of M. Basis, March 24, 1945	6,625		26,324		42,920		†98,193			

Unfinished gasoline stocks included are: *8,887,000 bbls; †12,029,000 bbls.

Daily Ave. Pennsylvania Crude Runs

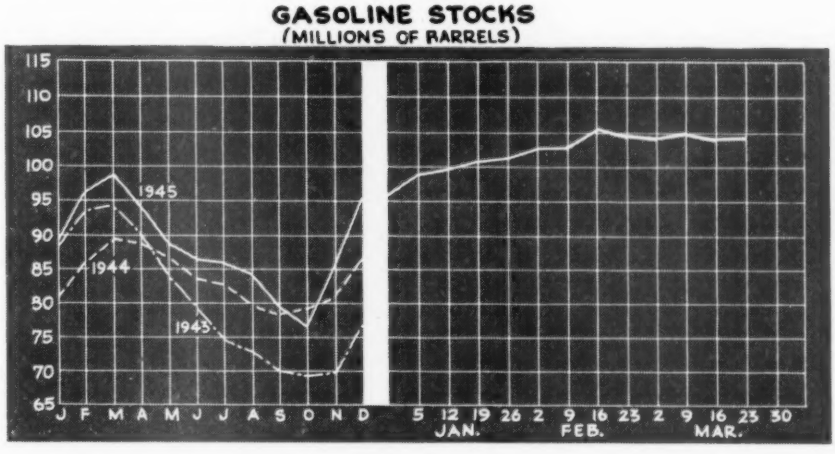
(Compiled by National Petroleum Assn. from reports of all companies refining Pennsylvania crude. Figures in bbls.)

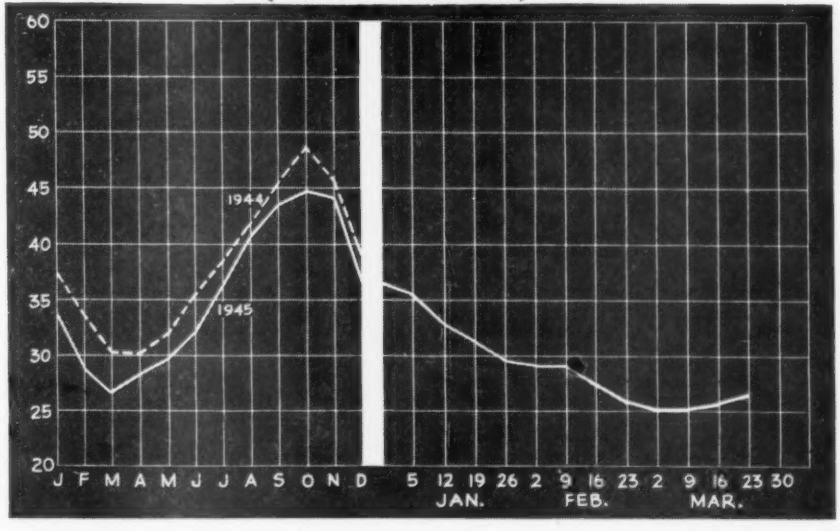
Week Ended Mar. 23, 1946	Week Ended Mar. 16, 1946	Week Ended Mar. 24, 1945
59,503	48,052	60,927

U. S. Crude Oil Production

(American Petroleum Institute figures)

	WEEK ENDED March 23 Barrels (Daily Average)	March 16 Barrels (Daily Average)
Oklahoma	°367,500	371,500
Kansas	°259,400	252,750
Nebraska	° 800	800
Texas	1,817,500	1,817,500
Louisiana	375,800	375,900
Arkansas	77,250	77,000
Mississippi	55,250	55,100
Alabama	1,000	1,000
Florida	100	100
Illinois	208,650	206,150
Indiana	17,650	17,900
Eastern (Ill., Ind. & Ky. excluded)	63,650	65,100
Kentucky	32,000	32,150
Michigan	44,300	43,250
Wyoming	111,650	110,300
Montana	20,100	20,150
Colorado	22,550	25,400
New Mexico	95,600	95,600
California	860,200	846,900
Total, U. S.	4,430,950	4,414,550





Pacific Coast Demand

(Bureau of Mines figures in thousands of b/d)

	Gasoline 1945	Gasoline 1946	Gas Oil & Diesel 1945	Gas Oil & Diesel 1946	Heavy Fuel Oil 1945	Heavy Fuel Oil 1946	All Products 1945	All Products 1946
January	304	248	104	139	545	432	1,066	917
February	315	...	100	...	594	...	1,124	...
March	332	...	94	...	519	...	1,068	...
April	406	...	83	...	536	...	1,148	...
May	402	...	75	...	520	...	1,135	...
June	398	...	64	...	490	...	1,085	...
July	396	...	59	...	421	...	1,011	...
August	370	...	78	...	434	...	1,010	...
September	363	...	76	...	400	...	954	...
October	269	...	76	...	443	...	897	...
November	271	...	106	...	418	...	901	...
December	265	...	117	...	479	...	969	...
Jan.-Dec.	340	...	86	...	482	...	1,030	...

Mid-Continent Lubricating Oils

(All figures are in barrels of 42 gallons)

	Bright Stock	Viscous Neutrals	Paraffin Oils	Steam Refined Stock	Blended Oils
Production	230,312	317,289	73,815	9,636	362,368
Shipments:					
Domestic	214,545	335,275	79,173	16,038	330,784
Export	17,572	1,067		329	28,583
TOTAL	232,117	336,342	79,173	16,367	359,367
Inventory Jan. 31, '46	350,506	237,182	62,131	33,773	186,020
Days Supply	48	23	.....	.....	.....

Pennsylvania Lubricating Oils

(Compiled by National Petroleum Assn. from reports of companies refining Pennsylvania Grade crude oil. Figures in bbls.)

	Production Jan., 1946	Inventory Jan., 1946	Production Dec., 1945	Inventory Dec., 1945
Raw Long Residuum	31,805	24,447	35,154	30,812
600 Steam Refined Stock	256,866	114,723	248,433	104,838
Other Steam Refined Stock	57,962	47,351	41,786	39,357
Finished Dewaxed Long Residuum	35,132	28,655	40,440	25,557
Bright Stock	165,390	235,567	168,829	234,086
Viscous Neutral (below 180 Vis.)	54,274	128,201	55,214	136,151
Viscous Neutral (180 Vis. at 100)	93,867	80,107	113,105	93,516

Production of Natural Gasoline

(Bureau of Mines figures in gallons, 000 omitted)

	Jan., 1946	Dec., 1945
East Coast		
W. New York	1	1
W. Pennsylvania	1,243	1,255
West Virginia	10,553	10,576
Ohio	594	632
Illinois	14,082	14,091
Kentucky	5,145	5,131
Michigan	1,107	1,109
Kansas	6,687	6,833
Oklahoma	36,901	35,929
Texas:	189,016	186,864
Gulf	48,489	45,674
East Texas	27,106	25,511
Panhandle	46,312	49,534
Other	67,109	66,145
Arkansas	7,179	7,539
Louisiana	52,147	50,080
Gulf	29,454	27,493
Inland	22,693	22,587
New Mexico	7,493	7,197
Colorado	*	‡
Montana	518	527
Wyoming	*3,591	‡3,250
California	78,799	73,483
Total	415,056	404,497
Daily Average	13,389	13,048
Total (thousands of bbls.)	9,882	9,631
Daily Average	319	311

* Wyoming includes Colorado and Utah drip gasoline.
‡ Wyoming includes Colorado drip gasoline.

Dealer and Service Station Gasoline Prices in 50 Representative U. S. Cities March 1, 1946

(American Petroleum Institute Figures)

City	Dealers' Net Price (Ex. Tax)	Indicated Dealer Margin	Gasoline Tax (Inc. 1½ Cent Federal Tax)	Service Station (Inc. Tax)
Average United States	9.86	4.29	6.07	20.22
Portland, Me.	9.5	4.1	5.5	19.1
Manchester, N. H.	10.2	4.5	5.5	20.2
Burlington, Vt.	10.0	4.2	5.5	19.7
Boston, Mass.	9.1	4.1	4.5	17.7
Providence, R. I.	9.0	4.8	4.5	18.3
Hartford, Conn.	9.4	4.5	4.5	18.4
Buffalo, N. Y.	9.2	4.8	5.5	19.5
New York, N. Y.	9.0	5.8	5.5	20.3
Newark, N. J.	8.7	5.0	4.5	18.2
Philadelphia, Pa.	8.7	4.3	5.5	18.5
Dover, Del.	9.2	4.6	5.5	19.3
Baltimore, Md.	8.45	3.95	5.5	17.9
Washington, D. C.	8.7	4.3	4.5	17.5
Charleston, W. Va.	10.3	4.8	6.5	21.6
Norfolk, Va.	8.7	6.1	6.5	21.3
Charlotte, N. C.	9.8	4.5	7.5	21.8
Charleston, S. C.	9.2	5.0	7.5	21.7
Atlanta, Ga.	10.25	4.25	7.5	22.0
Jacksonville, Fla.	9.5	4.0	8.5	22.0
Birmingham, Ala.	9.75	4.75	8.5	23.0
Vicksburg, Miss.	9.25	5.25	7.5	22.0
Memphis, Tenn.	8.9	4.5	8.5	21.9
Lexington, Ky.	10.25	3.75	6.5	20.5
Youngstown, Ohio	9.5	3.0	5.5	18.0
South Bend, Ind.	10.2	4.8	5.5	20.5
Chicago, Ill.	9.6	2.76	4.5	16.86
Detroit, Mich.	9.6	3.84	4.5	17.94
Milwaukee, Wisc.	10.3	4.6	5.5	20.4
Twin Cities, Minn.	10.1	4.8	5.5	20.4
Fargo, N. Dak.	11.1	4.3	5.5	20.9
Huron, S. Dak.	10.5	4.0	5.5	20.0
Omaha, Neb.	9.6	3.0	6.5	19.1
Des Moines, Ia.	9.6	3.8	5.5	18.9
St. Louis,, Mo.	9.5	3.0	4.5	*17.0
Wichita, Kans.	8.6	3.4	5.5	17.5
Tulsa, Okla.	8.0	3.0	9.0	20.0
Little Rock, Ark.	9.2	4.8	8.0	22.0
New Orleans, La.	8.45	5.05	8.5	22.0
Houston, Texas	8.5	4.5	5.5	18.5
Albuquerque, N. Mex.	10.5	4.5	7.0	**22.00
Denver, Colo.	10.0	4.0	5.5	19.5
Casper, Wyo.	11.5	5.0	5.5	22.0
Butte, Mont.	9.5	4.0	6.5	20.0
Boise, Ida.	13.5	4.0	7.5	25.0
Salt Lake City, Utah	13.5	4.5	5.5	23.5
Reno, Nev.	12.0	4.0	5.5	21.5
Phoenix, Ariz.	12.0	4.0	6.5	22.5
San Francisco, Calif.	10.0	4.0	4.5	18.5
Portland, Ore.	10.5	4.0	6.5	21.0
Spokane, Wash.	12.5	4.0	6.5	23.0

* Includes City Tax of $.0100.
** Includes City Tax of $.0050.

Pennsylvania Oils Other Than Lubes at Refineries

(Compiled by National Petroleum Assn. from reports of oil region refiners. Figures in barrels.)

	Jan. 1946	Dec. 1945
Naphthas & Gasoline		
(1) Straight run, unblended and/or unleaded for sale as motor fuel	2,720	4,130
(2) Naphtha and gasoline, for sale for blending or further refining, or held at refinery for further distillation, reforming, blending or leading	319,949	295,070
(3) Below 65 octane, not included in (1) or (2) above	3,597	1,245
(4) 65 octane and above	409,877	392,707
Salable Naphthas other than motor fuel (does not include refinery process naphthas)	20,179	19,226
Kerosine	58,313	81,816
36/40 gas oil (include furnace oil)	61,740	48,122
Fuel oil (not reported above)	22,535	42,641
Oils held as cracking plant charging stocks	321,565	362,091
Non-viscous neutral	32,430	23,190
Wax distillate	71,064	72,427
Crude petrolatum	41,044	40,189
Wax (lbs.)	3,744,313	4,564,437

Net Stocks Of Pennsylvania Crude Oil

(Compiled by National Petroleum Assn. Figures in bbls.)

	Jan. 31, 1946	Dec. 31, 1945	Jan. 31, 1945
At Refineries	265,410	310,032*	276,789
Pipeline and Tank Farm	1,422,859	1,278,770	1,352,696
Total	1,688,269	1,588,802*	1,629,485

*Correction due to error in reporting by one company.

Humble to Use Toluene Plant For Oil Products, WAC Says

NPN News Bureau

WASHINGTON—War Assets Corp. reports officially that Humble Oil and Refining Co. will use the Baytown ordnance works toluene plant at Baytown, Tex., which it bought from government for $6,948,394 cash, for production of "petroleum products, chiefly gasoline components."

"Although the company expects to produce some toluene," WAC said, "the national capacity for the production of toluene from coal-tar is estimated to be adequate for normal peacetime needs."

Justice Department officials, who reviewed terms of sale and approved agreement, said there was no provision which placed any restriction on use of the plant. In response to specific inquiry, WAC also said "the proposed disposal does not place any restriction on the use to be made of this toluene plant."

WAC's announcement said the sale, which is subject to priority rights of federal government agencies, included all usable facilities of the plant. Actual cost of entire plant, including catalysts, chemicals, spare parts and operating supplies on hand as of August 1945, amounted to $14,185,866, and purchase price represents 100% return on present estimated fair value of plant's usable facilities.

Oil Truckers' Tires, Tubes to Contain More Natural Rubber

NPN News Bureau

WASHINGTON — More natural rubber for oil tank and other truck and bus tires and inner tubes was assured March 26, in CPA announcement of immediate increase of 5500 long tons in monthly allowable—up about 50% from present quota.

Increase was effected by amending Appendix II to amended Rubber Order R-1, which:

Grants permission for use of natural rubber instead of butyl in inner tubes for truck tires of 8.25-inch cross-section and larger. (CPA said a later amendment to rubber order will make mandatory this use of natural rubber because of heavy other demands for butyl.)

Grants increases to 33% in natural rubber for 7.50-16 six and eight-ply small truck tires. In other small truck tires in 7.50 and 7.00 sizes natural rubber was upped to 23%.

Permits natural rubber up to 67% in medium and large truck tires.

Permits substitution of natural rubber for GR-S, general purpose synthetic, in production of highway solid tires.

Makes available natural rubber for retreading materials.

Navy Returns All But Two Oil Properties to Owners

NPN News Bureau

WASHINGTON — Gulf Oil Corp.'s 178,000 b/d refinery at Port Arthur, Tex., was turned back to management March 30, by the Navy. Only Gulf's Toledo plant and American Liberty's Texas City, Tex., refinery now remain under Navy control.

The management-union agreement at Port Arthur calls for 18% wage increase and 4- and 6-c shift differentials on return to a 40-hour week as of April 1.

GASOLINE CONSUMPTION BY STATES, DECEMBER, 1945

(American Petroleum Institute Figures)

	Tax Rate† Dec., Cents	Month of Nov., 1945 Gallons	Month of Dec., 1945 Gallons	Month of Dec., 1944 Gallons	Change %	12 Months Ending With Dec., 1945 Gallons	12 Months Ending With Dec., 1944 Gallons	Change %
Alabama	6	28,572,000	27,547,000	23,134,000	+19.08	307,359,000	263,087,000	+16.83
Arizona	5	12,682,000	13,818,000	10,081,000	+37.07	133,051,000	129,269,000	+ 2.93
Arkansas	6½	19,488,000	20,407,000	15,065,000	+35.46	214,905,000	179,266,000	+19.88
California	3	250,862,000	261,582,000	211,472,000	+23.70	2,794,699,000	2,417,752,000	+15.59
Colorado	4	21,449,000	20,207,000	21,352,000	— 5.34	296,563,000	297,076,000	— .17
Connecticut	3	26,188,000	26,328,000	23,043,000	+14.26	300,000,000	273,222,000	+ 9.80
Delaware	4	4,676,000	4,446,000	3,751,000	+18.53	54,923,000	50,211,000	+ 9.38
District of Columbia	3	10,954,000	10,832,000	9,220,000	+17.48	118,066,000	108,739,000	+ 8.58
Florida	7	40,577,000	44,022,000	34,337,000	+28.21	427,716,000	381,486,000	+12.12
Georgia	6	41,085,000	40,181,000	32,829,000	+22.39	435,290,000	377,099,000	+15.43
Idaho	6	9,401,000	8,370,000	7,068,000	+18.42	110,686,000	95,669,000	+15.70
Illinois	3	114,817,000	105,424,000	87,741,000	+20.15	1,273,228,000	1,166,325,000	+ 9.17
Indiana	4	61,935,000	54,950,000	48,646,000	+12.96	760,911,000	698,877,000	+ 8.88
Iowa	°4	53,879,000	39,402,000	32,131,000	+22.63	598,042,000	524,812,000	+13.95
Kansas	3	38,168,000	34,682,000	28,721,000	+20.75	493,776,000	442,169,000	+11.67
Kentucky	5	29,958,000	26,180,000	24,751,000	+ 5.77	366,883,000	294,778,000	+24.46
Louisiana	7	31,749,000	31,845,000	25,093,000	+26.91	347,646,000	306,067,000	+13.58
Maine	4	11,883,000	11,388,000	10,042,000	+13.40	145,569,000	130,727,000	+11.35
Maryland	4	26,518,000	25,519,000	26,567,000	— 3.94	328,912,000	295,377,000	+11.35
Massachusetts	3	52,004,000	52,156,000	46,268,000	+12.73	599,228,000	538,091,000	+11.36
Michigan	3	96,541,000	94,604,000	84,810,000	+11.55	1,171,630,000	1,083,842,000	+ 8.10
Minnesota	4	47,302,000	37,215,000	32,041,000	+16.15	531,432,000	463,239,000	+14.72
Mississippi	6	24,408,000	19,646,000	13,885,000	+41.49	235,548,000	205,778,000	+14.47
Missouri	2	54,677,000	48,851,000	37,983,000	+28.61	586,867,000	514,892,000	+13.98
Montana	5	9,687,000	8,795,000	7,382,000	+19.14	132,828,000	116,315,000	+14.20
Nebraska	5	22,902,000	19,530,000	17,962,000	+ 8.73	267,488,000	235,554,000	+13.56
Nevada	4	4,341,000	3,966,000	3,592,000	+10.41	51,773,000	61,573,000	—15.92
New Hampshire	4	6,604,000	6,575,000	5,264,000	+24.91	76,509,000	66,695,000	+14.71
New Jersey	3	63,536,000	64,206,000	56,544,000	+13.55	748,063,000	691,877,000	+ 8.12
New Mexico	5	11,766,000	11,656,000	9,443,000	+23.44	130,014,000	110,821,000	+17.32
New York	4	134,115,000	128,871,000	113,656,000	+13.39	1,490,982,000	1,392,528,000	+ 7.07
North Carolina	6	47,779,000	43,332,000	31,336,000	+38.28	477,627,000	408,282,000	+16.98
North Dakota	4	11,615,000	7,627,000	8,095,000	— 5.78	189,608,000	171,126,000	+10.08
Ohio	4	110,527,000	113,338,000	100,475,000	+12.80	1,403,624,000	1,365,851,000	+ 2.77
Oklahoma	7½	36,579,000	34,661,000	47,119,000	—26.44	572,002,000	477,928,000	+19.68
Oregon	5	23,550,000	23,457,000	21,632,000	+ 8.44	279,799,000	263,069,000	+ 6.36
Pennsylvania	4	116,064,000	111,247,000	89,503,000	+24.29	1,263,481,000	1,132,473,000	+11.57
Rhode Island	3	9,449,000	9,874,000	11,220,000	—12.00	124,355,000	120,664,000	+ 3.06
South Carolina	6	22,109,000	20,919,000	17,163,000	+21.88	225,618,000	198,025,000	+13.93
South Dakota	4	13,375,000	8,534,000	8,840,000	— 3.46	156,515,000	133,659,000	+17.10
Tennessee	7	38,046,000	34,619,000	25,688,000	+34.77	382,751,000	333,938,000	+14.62
Texas	4	165,485,000	179,424,000	369,544,000	—51.45	4,129,128,000	4,104,157,000	+ .61
Utah	4	10,309,000	9,316,000	9,352,000	— .38	120,348,000	104,562,000	+15.10
Vermont	4	5,038,000	4,631,000	3,746,000	+23.63	54,605,000	44,980,000	+31.40
Virginia	5	40,038,000	37,744,000	34,361,000	+ 9.85	462,070,000	433,323,000	+ 6.63
Washington	5	34,365,000	36,004,000	31,715,000	+13.52	415,410,000	377,524,000	+10.04
West Virginia	5	16,866,000	14,395,000	11,742,000	+22.59	189,351,000	159,548,000	+18.68
Wisconsin	4	49,429,000	43,173,000	34,820,000	+23.99	576,926,000	483,826,000	+19.24
Wyoming	4	6,978,000	6,078,000	6,907,000	—12.00	75,327,000	70,864,000	+ 6.30
Total		2,120,325,000	2,041,574,000	1,967,142,000		26,629,132,000	24,297,012,000	
Daily Average		70,678,000	65,857,000	63,456,000		72,957,000	66,567,000	
Change from previous year:								
Total Change			+74,432,000			+2,332,120,000		
Percentage change in Daily Average			+3.78%			+9.60%		

° Increased 1c on July 4, 1945.

† These are state tax rates per gallon. In addition there is the federal tax of 1.5c per gallon.

CLASSIFIED

For Sale

BELCHER built 3300 gallon tank trailer. Single compartment, 10.00x2-tires, dual, air brakes, good condition. Price $2100.00. Nolan Brown Truck Division, 1920 N. Miami Ave., Miami, Florida.

ENGINE-TRAILERS

CT engine completely overhauled; new block. Price $1250.00.
14 tank trailers, gallonage and compartment sizes 3625 to 4500 and 1 to 5 compartments. Full descriptions and prices on request.

LANCASTER MOTOR TRUCK SERVICE
459 Juliette Ave. Lancaster, Pa.
Phone 6101

TRACTOR-TRAILER

Two-ton Dodge tractor, 3015 gallon tank, Fruehauf semi-trailer with 2½" meter. Excellent condition, fully equipped, all necessary accessories, ready for use.

P. O. BOX 167
Charles Town, W. Va.

FOR SALE

New and used railroad tank car tanks, 8,000 to 10,000 gallons. Good condition. Immediate delivery.

EMPIRE EQUIPMENT CORPORATION
608 Empire Bldg., Cleveland 14, Ohio
Phone: Main 7667

TRACTOR-TRUCK AND TANK TRAILER

1939 Studebaker 3½ ton tractor-truck, model K30 with 900x20 tires, equipped with take-off pump. Fruehauf 1939 semi-tank trailer, 4000 gallons capacity. Will sell complete or tractor and trailer separately below ceiling prices.

PETROLEUM SPECIALTIES, INC.
Flat Rock, Michigan
Phone: Flat Rock 300

TANKS-FITTINGS

FOR IMMEDIATE DELIVERY

150 gallon Butane Tanks and fittings, also 250 and 500 gallon Propane Tanks and fittings.

FOR DELIVERY IN 30 DAYS

750 gallon and 1000 gallon Propane tanks and fittings.

KENNEY TANK INSTALLATION CO.
2132 N. Halsted St.
Chicago 14, Illinois

FILLING STATION

Trackside filling station centrally located on property owned in fee in a city of 10,000 population. Storage consists of 60,000 gallons. Open throughout the war. Doing a nice volume of business on gasoline, lubrication and tires. Owner desires to retire on account of health. Apply:

P. O. Box 561
Galion, Ohio

For Sale

TANK TRAILER

Columbia 3200 gallon tank trailer. Single compartment, good condition, air brakes, dual 10.00x20 tires. Ready to go to work. Price $2000.00.

NOLAN BROWN TRUCK DIVISION
1920 N. Miami Ave. Miami, Florida

TRUCK-TRACTOR AND TRAILER

1938 International Model DS-35 Truck-Tractor. Just overhauled, excellent 9.00x20 tires and looks good. And a 1942 Columbia 3450 gallon oil tanker trailer, two compartments, completely equipped with two-way pump, hose reel and meter. Priced to sell quick at $4350.00—far below OPA ceiling.

NOLAN BROWN TRUCK DIVISION
1920 N. Miami Ave. Miami, Florida

TRACTOR-TRAILER

Three ton Dodge tractor, 3400 gallon two compartment tank, Great Dane semi-trailer. Excellent condition, fully equipped, all necessary accessories, ready for use.

P. O. BOX 167
Charles Town, W. Va.

Wanted To Buy Or Lease

WANTED TO BUY OR LEASE—grease and oil compounding plant, located at or near large industrial area. Box 804.

Positions Wanted

PILOT interested in flying for individual or company. Licensed by government to fly all types of aircraft in any weather. Five years' commercial experience and three years' Navy. Box 802.

PLANT MANAGER or EXECUTIVE ASSISTANT—Young chemical engineer with ten years experience in development and manufacturing of oil specialties, metal working products, detergents, industrial cleaners, etc. Position must be one with a future and be an Eastern location. Box 13.

WANTED—position where a knowledge of French and of France will be of value. Am a native American of French descent, graduate Fordham University; served 4 years in the U. S. Army as an officer; 1½ years overseas in the Intelligence Department; was in France with the Intelligence Department from 1944 to 1946 until two months ago; can speak and write French fluently; have good knowledge of French economic and political situation; 29 years old; should be able to put this education and knowledge of French at the service of someone in or allied with the oil industry. Reply Box 808.

SALES

Intelligent, young, aggressive and highly qualified. Conversant with research, development and testing of automotive chemical specialties; wholesale and retail automotive marketing; marketing of oils through distributor outlets. Possess fine personality and mature judgment. Desire a sales or sales engineering opportunity with manufacturer or refiner marketing nationally. Territorial preference; mid-west.

BOX 10

Situations Open

WANTED: Experienced Oil Burner Engineer salesman to organize and build Oil customers for coal company, Springfield, Mass. Box 11.

WANTED young man to handle operations of marketing company. Give complete history of previous and present connections, age, education, experience, references and minimum salary expected. Permanent position. Preference given man located in New England area. Box 14.

FUEL SALESMAN

The largest and most aggressive dealer, in a Connecticut city of 185,000 inhabitants, is desirous of obtaining the services of an experienced fuel salesman to solicit Industrial and Apartment House accounts.
Must have knowledge of both Solid and Liquid fuel combustion.

BOX 12

SALES ENGINEER

Old established manufacturer of lubricants and specialties has opening in Metropolitan New York and North Jersey territory. Preference given to party who has established connections in industrial plants and machine shops. Salary and commission. In reply please give detailed experience.

BOX 809

Business Opportunities

PETROLEUM PRODUCTS

Doing approximately $100,000 year now, with many nationally known corporations. Established since 1931. Has netted owner $25,000 to $35,000 annually. Can be built into a $500,000 business; owner will assist for two or three months. Call Mr. Town.

KING-CLARKE COMPANY
318 Schofield Bldg., Cleveland, Ohio
Phone: Main 6700

ADVERTISERS' INDEX

This index is published as a convenience to the reader. Every care is taken to make it accurate but National Petroleum News assumes no responsibility for errors or omissions.

Anderson-Prichard Oil Corp. 25
Fleet-Wing Corp. ..... Outside Back Cover
General American Transportation Corp. ... 18
International Harvester Co. 35
Kellogg Co., M. W. 21
Kidde & Co., Inc., Walter 33
Morrison Bros. Co. ..... Inside Front Cover
National Cash Register Co. 38
National Foam System, Inc. Inside Back Cover
National Petroleum News 39
Neptune Meter Co. 23
New York Lubricating Oil Co. 31
Oil-Heat Institute of America, Inc. 43
Philadelphia Valve Co. 17
Republic Oil Co. 1
Rieke Metal Products Corp. 15
Timken-Detroit Axle Co. 40
Wayne Pump Co. 28-29
Wood River Oil & Refining Co., Inc. 34
Wynne Oil Co. 32

Welcome Back . . . . . .

Lt. Cmdr. Osmun Skinner has resumed his duties as vice-president of the Van Dyne Oil Co., independent distributor at Troy, Pa., after serving in the Navy for two years. Up to April 3, when he went on terminal leave, he had been executive assistant to the executive officer of the Naval Petroleum Plants Office from the time the Navy was ordered to seize strike-bound oil plants last fall. Previously, he was in the Bureau of Ships electronic division, in charge of negotiation of all sonar (underwater sound detection device) contracts.

° ° °

Byron B. Loomis has returned to Colonial Beacon Oil Co. after nearly five years' service with the Navy. He has been promoted to personnel and public relations manager of Colonial Beacon. Formerly he was sales engineer for the company's Albany, N. Y., district.

Mr. Loomis

He was called to active duty with the Naval Reserve in 1941, having graduated from Annapolis in 1925. For three years he was in charge of engineering work on the maintenance and repair of aircraft carriers. He received a citation from the Chief of the Bureau of Ships for his work in speeding the repair of battle damage on ships.

During the last year of the war he was in the Pacific as Chief of Staff in the Amphibious Attack Transport Division. He took part in the Okinawa invasion and planned operations for a task force to make an initial landing at Wakayama in the occupation of Japan.

° ° °

Lt. Cmdr. K. W. Newerf of USNR has returned to inactive duty and is back with Richfield Oil Co. Shortly after the outbreak of war he was commissioned a lieutenant in the USNR. He was sent to Harvard University for a period of instruction and then overseas to Adak in the Aleutians where he was Communications Officer until October, 1943.

Cmdr. Newerf was then sent to the Port Director's Officer in New York where he worked with Cmdr. A. Y. Lanphier, Assistant Port Director for Petroleum. After five months he was sent to Washington to aid in the formation of the Allied Tanker Co-ordinating Committee and remained there until July, 1944.

Then Cmdr. Newerf was ordered to Europe where, under Cmdr. W. H. Henszey, USNR, a friend and oil man from Los Angeles, he participated in the occupation of Brittany. He then returned to England where he became Executive Officer of the U. S. Naval Amphibious Base at Salcombe, Devon. He held this post until V-E Day when the base was closed and all personnel returned to the states.

Cmdr. Newerf started to work for Richfield in 1929 after graduating from the University of Southern California. He handled sales to India, New Zealand and Japan. After the upheaval of 1930-31 put a stop to this activity, he carried on in the company's real estate department where he was working when he entered the Navy. He lives in Los Angeles.

° ° °

Dr. Charles H. Brooks, process engineer of Sun Oil Co., has returned to his job after four and a half years in the Navy. Entering as a lieutenant (jg), he was assigned to the Bureau of Ordnance in Washington, where he became chief of the powder, explosives and ammunition chemicals sub-section of the ammunition section, having charge of the procurement, test, acceptance and distribution of all gunpowder, rocket powder, explosives and ammunition chemicals. He also worked on problems of handling and use of these materials, and the development of Navy-type rocket powder both as to methods of production and ingredients.

Dr. Brooks

Dr. Brooks rose through the ranks to become a full commander, and was a member of a U. S. Naval Technical Mission to Europe in June, 1945, which studied German technology in the manufacture of the war materiel he was closely concerned with. For his work in the Bureau of Ordnance he received the Navy Letter of Commendation ribbon. Dr. Brooks received his BS from Yale, and his MS and DSc from the University of Michigan. He joined Sun Oil in 1936.

° ° °

Joseph T. Foley has been elected vice president of Home Oil Co., Passaic, N. J., and its affiliate, Petroleum Holding Co., also of Passaic.

Mr. Foley began his oil career in 1930 with Pan American Petroleum & Transport Co. and served successively in the New Jersey Division as salesman, bulk terminal manager, manager of the fuel and lube oil departments, sales promotion manager, special representative and finally as assistant to the general sales manager in New York from 1938 to 1944. In the latter year Mr. Foley was commissioned lieutenant in the Naval Reserve, serving as fuel officer in the Asiatic-Pacific Theater and later as assistant officer in charge of the naval fuel depot at Newport, R. I., until his recent separation from the service.

Mr. Foley

Contributions Welcomed!

NPN welcomes contributions from readers for the Welcome Back page.

If you have a friend or an employe who has returned to an oil company after service in the armed forces, send information, including his, (or her) name, address, rank, places and type of service, decorations, civilian position to:

Welcome Back Editor
National Petroleum News
1213 West 3rd Street
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ABOUT OIL PEOPLE

R. J. (Bob) Rogers, president of the Indiana Independent Petroleum Assn., is scheduled to present a brochure April 3 at a meeting of the National Council of Independent Petroleum Assns. His subject will be "How Can the Marketing Division of the API Best Serve the Petroleum Industry."

Mr. Rogers, who was unable to attend the Indiana convention because of illness, is much improved after a visit in Virginia and North Carolina, and attended the API group sessions on marketing in Atlanta on April 2.

* * *

C. E. Shepard, manager of the Atlanta sales division for Gulf Oil Corp., and **C. H. Dougal,** Gulf's Pittsburgh sales division manager, joined the "leisure class" April 1 after many years of service leading to well earned retirement from active work.

Mr. Shepard's service with Gulf dates back to 1911, and Mr. Dougal's first pay check was dated in 1918.

With the retirement of Messrs. Shepard and Dougal, assistant district managers **G. E. Millican** of Atlanta, and **G. F. Hunker** of Pittsburgh, step up to succeed them. Following in their steps will be **H. G. Russell** of Atlanta, and **C. C. Gunst,** who was district manager in the Pittsburgh area.

* * *

M. L. Margenau has been appointed director of public relations for Cities Service Oil Co., succeeding the late R. J. Daugherty.

After graduation from the University of Wisconsin with a B.S. degree in electrical engineering, Mr. Margenau became affiliated with Cities Service Co. in 1917 as a cadet.

Mr. Margenau

Mr. Margenau is past president of the Joplin Lions Club and state secretary-treasurer and district governor of the Missouri Lions Clubs. He is credited with having originated the idea of the Easter Egg hunt, which has become a nationwide traditional observance. Active in Chamber of Commerce work, Mr. Margenau is past president of the Joplin Chamber and was representative of the governor of Missouri at the National Industrial Conference. As head of the Joplin Chamber, he was instrumental in organizing the Ozark Stockyards Co. of Joplin. He was a member of the State Newspaper and Editorial Assn. of Kansas and Missouri and is active in the American Gas Assn. and Hillcrest Country club of Bartlesville, Okla.

Allan H. Hand, former executive secretary-treasurer of the Petroleum Industry War Council, has been named vice president of the Ralph M. Parsons Co., of Los Angeles, Calif., which specializes in economic appraisals, engineering and management of refinery construction.

Mr. Hand

Mr. Hand will work out of Washington for the next several months. He came to Washington in 1941, organizing the Petroleum Price Division of OPA's Fuel Section. Later in same year he transferred to PAW (then OPC) and worked on transportation matters until Feb. 1, 1942 when he joined executive staff of PIWC. He formerly was with Union of California for 27½ years.

* * *

O. P. Cottrell has been appointed manager of manufacturing and research for Alliance Oil Corp., New York City, which he joined on Jan. 1, 1946.

Mr. Cottrell has been associated with the petroleum industry since 1917, when he was employed by Tide Water Oil Co. as a research chemist. He later became superintendent of the Avon refinery of Associated Oil Co. In 1928 he visited Japan to survey the producing, refining and marketing of petroleum and its products, and also made many trips to Europe to follow technical developments. In 1935 he joined The Texas Co. in an administrative capacity. He resigned in 1944.

Mr. Cottrell is credited with responsibility for installing the first solvent refining process in the American petroleum industry which was first adapted to kerosine. He also developed a new process to mix benzol and sulphur dioxide for solvent refining and solvent dewaxing within the same plant.

* * *

Dr. Walter Miller has been retained by Universal Oil Products Co. as a consultant on refining techniques and operations. He retired as vice president in charge of manufacturing for Continental Oil Co. on March 1 (see NPN March 6, p. 72).

Dr. Walter Miller, who retired March 1 as vice president in charge of manufacturing for Continental Oil Co, Ponca City, Okla., to engage as a consultant in refinery engineering, has been retained by Universal Oil Products Co. as a consultant on refining techniques and operations. He will continue to maintain an office in the Continental Oil Co. building, Ponca City.

COMING MEETINGS

APRIL

Empire State Petroleum Assn., Inc., annual convention, Hotel Mark Twain, Elmira, N. Y., April 10-11.

Independent Oil Men's Assn. of New England, convention at Statler Hotel, Boston, Mass., April 11-12.

American Petroleum Institute, Production Division, Biltmore Hotel, Los Angeles, April 11-12.

Interstate Oil Compact Commission, spring meeting, Tulsa Hotel, Tulsa, April 11-13.

Eastern Petroleum Credit Group, 9th annual conference, Copley Plaza Hotel, Boston, April 15-16.

Natural Gasoline Assn. of America, annual convention, Baker Hotel, Dallas, Texas, April 17-18-19.

National Petroleum Assn., Hotel Cleveland, Cleveland, O., April 18-19.

Michigan Petroleum Assn., spring convention and trade exhibit, Leland Hotel, Detroit, April 23-24.

National Oil Heat Exposition, sponsored by Oil-Heat Institute of America, Inc., Philadelphia, April 23-27.

Independent Petroleum Assn. of America, mid-year meeting, Houston, Tex., April 29, 30 and May 1.

MAY

National Association of Corrosion Engineers, President Hotel, Kansas City, May 7, 8, and 9.

National Oil Scouts & Landsmen's Assn., Hotel Heidelberg, Jackson, Miss., May 23-25, 1946.

American Petroleum Institute, Production Division, Shreveport, La., Washington-Youree Hotel, May 17-18.

JUNE

Society of Automotive Engineers, Summer (Semi-Annual) Meeting, Hotel French Lick Springs, French Lick, Ind., June 2-7.

American Petroleum Institute, Production Division, Skirvin Hotel, Oklahoma City, June 6-7.

American Petroleum Institute, Production Division, spring meeting, William Penn Hotel, Pittsburgh, Pa., June 13-14.

Oil Heat Institute of New England, annual exposition, Hotel Statler, Boston, June 24-27.

Pennsylvania Grade Crude Oil Assn., annual meeting, William Penn Hotel, Pittsburgh, June 27-28.

AUGUST

Society of Automotive Engineers, West Coast Transportation & Maintenance meeting, Hotel New Washington, Seattle, Wash., Aug. 22-24.

SEPTEMBER

Chicago Section, American Chemical Society, Coliseum, Chicago, Sept. 10-14.

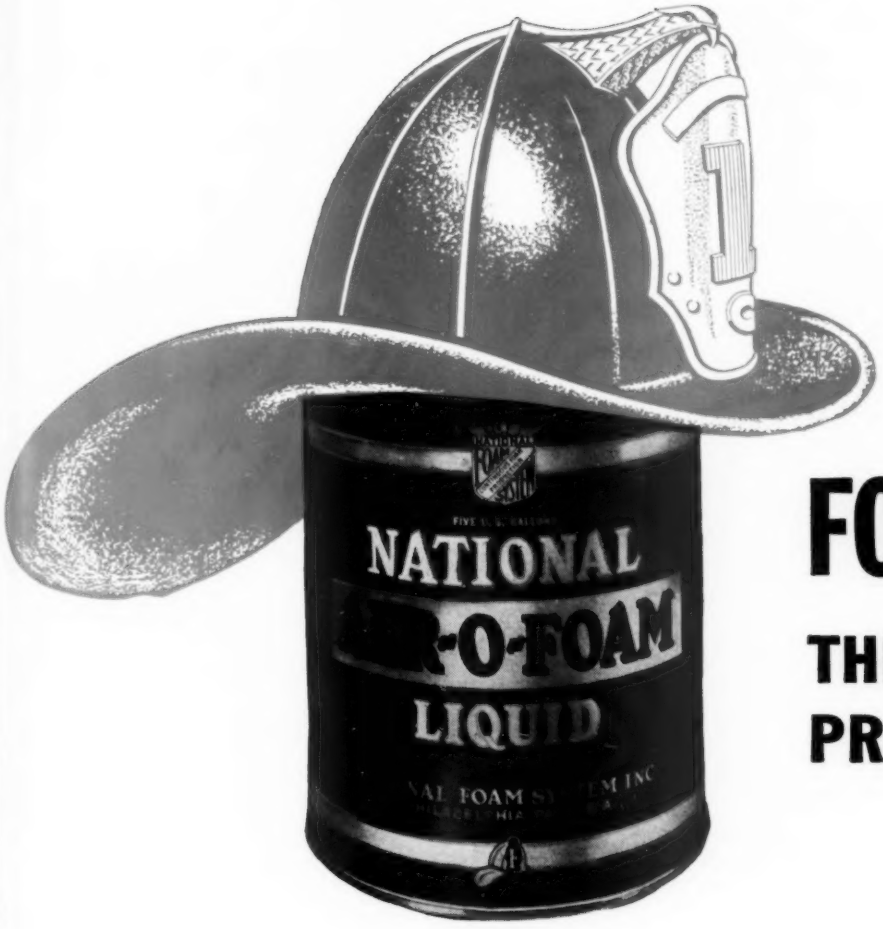
Society of Automotive Engineers, Tractor Meeting, Hotel Schroeder, Milwaukee, Wis., Sept. 11-12.

National Lubricating Grease Institute, 14th annual meeting, Edgewater Beach Hotel, Chicago, Sept. 29-Oct. 2.

OCTOBER

Society of Automotive Engineers, Aeronautic (Autumn) & Aircraft Engineering Display, Hotel Biltmore, Los Angeles, Oct. 3-5.

Society of Automotive Engineers, Transportation and Maintenance Meeting, Hotel Knickerbocker, Chicago, Oct. 16-17.



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TECHNOLOGY DEPT.

NATIONAL PETROLEUM NEWS

Monthly Technical Section Devoted to

REFINERY MANAGEMENT *and* PETROLEUM CHEMICAL TECHNOLOGY

Section Two | April 3, 1946 | Vol. 38, No. 14

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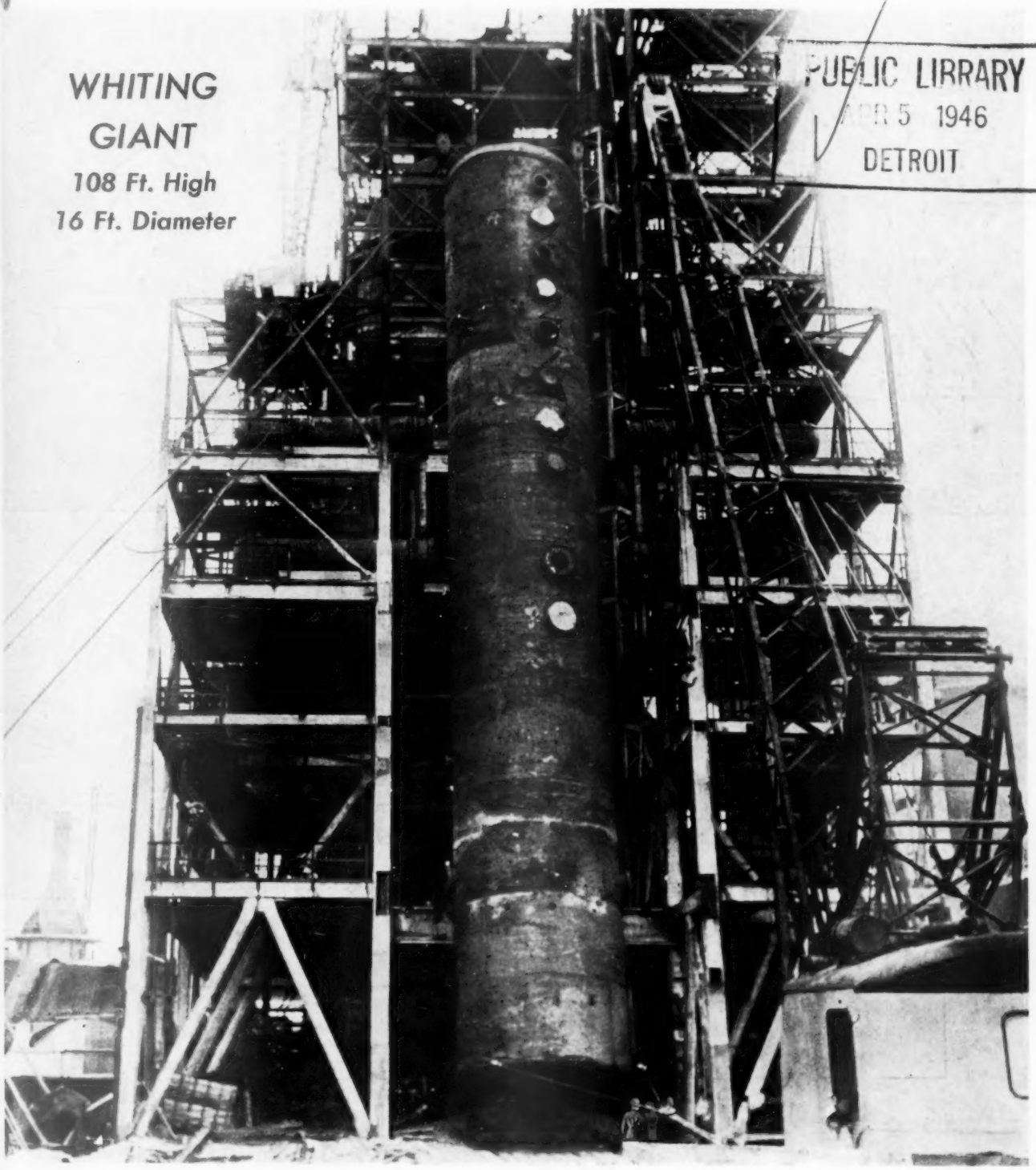
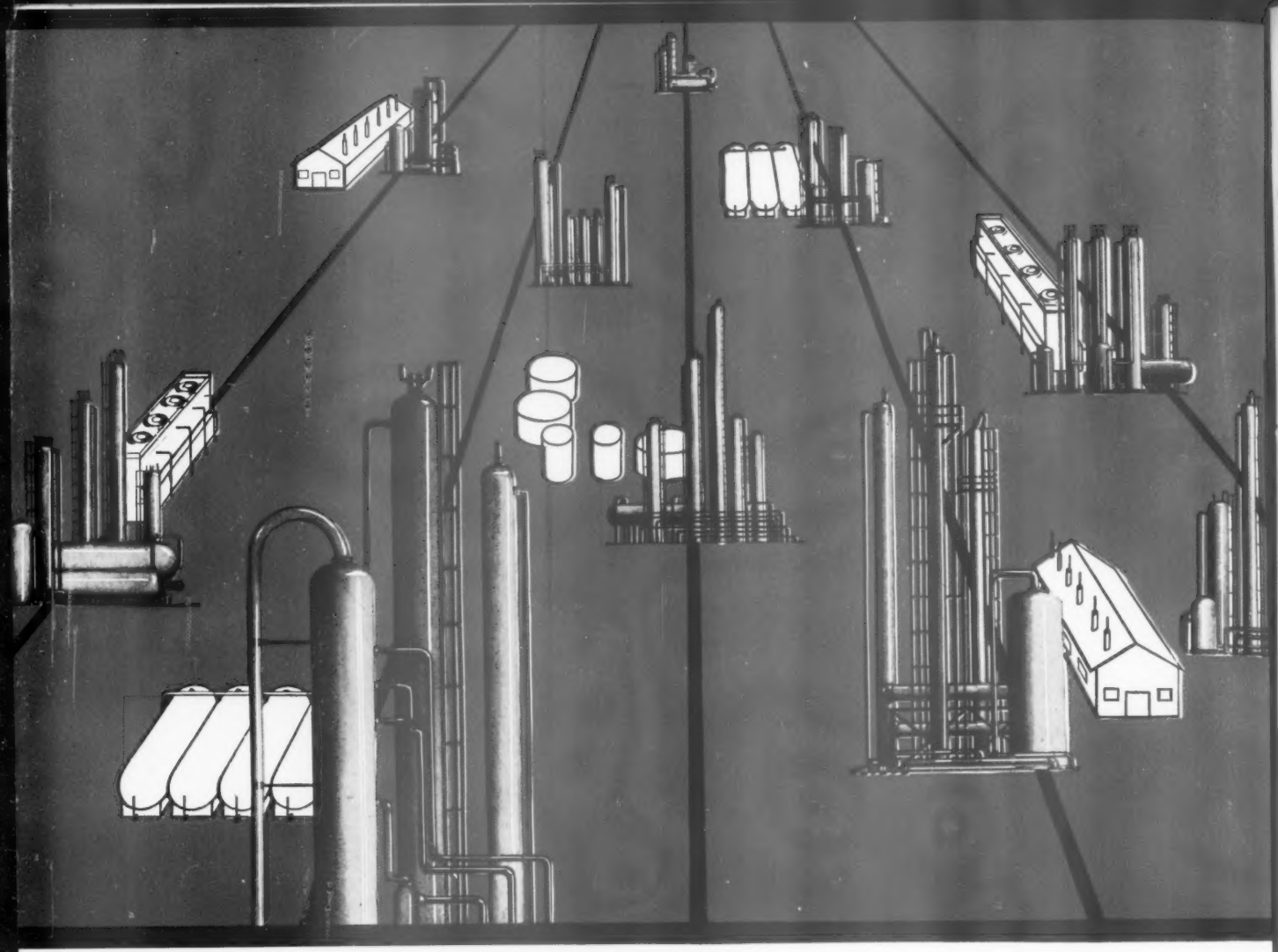
DETROIT

WHITING GIANT

108 Ft. High
16 Ft. Diameter



Final stage in erection of 108-ft., 16-ft. diameter fractionating tower in Fluid catalytic cracking unit at Whiting refinery of Standard Oil Co. (Indiana). It was lifted into position and bolted to the prepared base shown directly in rear. The tower is one of the largest shop-fabricated vessels ever shipped complete to a refinery. Additional details and photos with story on p. R-250.



Avenues of Progress

Hudson personnel has specialized in process design from the early days of single product absorption gasoline plants, when a plant processing 12 million feet daily was considered a large project, to the present era of high pressure plants in unitized fields, processing up to 350 million feet daily and producing as many as nine different liquid products.

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Contents

National Petroleum News, TECHNICAL SECTION

Vol. 38, No. 14—April 3, 1946

Refinery Equipment

New Type Chromium-Nickel Alloy Offers Wider Range of Refinery Applications R-243
By John S. Ewing

Shop Fabricated Tower ..... R-250★

Plant Operation

Plant Practices . . . for Refinery Superintendents and Foremen ..... R-254★

Proper Classification of Wastes First Step in Disposal Program (No. 4 in a Series) ..... R-292★
By W. B. Hart

Plant Design

Principles of Reactor Design. Article 1—Pyrolytic Dealkylation and Concentration of Aromatics ..... R-260★
By C. O. Reiser and K. M. Watson

Simplicity and Flexibility of TCC Process Fits It for Small-Scale Operations R-304
By H. D. Noll, E. V. Bergstrom and K. G. Holdom

Improved Fluid Unit Meets Needs of Smaller Refiner R-313
By Davis Read

Refining Processes

Commercial Methods for Manufacturing Wax in Germany Are Described (No. 3 in a Series) ..... R-273★
By J. Paul Jones (Translator)

Newly Developed Process Secures Pure Hydrocarbons from Petroleum ..... R-283★

Cracking of Heavy Petroleum Stocks Over Heated Surfaces R-286
By A. Ya. Larin

Departments

Tomorrow in Petroleum Technology ..... R-247★

Patent Trends in Petroleum Refining ..... R-251★
By Peter J. Gaylor

New Books for the Oil Man R-302

Petroleum Technologists in the Headlines R-318

Technical Meetings for Oil Men R-319

Widening Horizons R-320
"Inform Public on Oil Research in Peacetime as Well as in War"

★ EXCLUSIVE in this issue of the NPN TECHNICAL SECTION

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PREVIEW

OF MAY FEATURES

Advances in Electric Welding Aid Refinery Construction

Improved welding techniques, born of wartime necessity, are being employed to fabricate today's modern refineries. As a result, many of these new methods are becoming standard practice for refinery construction and maintenance.

One outstanding example of the application of modern welding is the 80,000 b/d Tutwiler plant of Cities Service Refining Corp., which employed 500 welders during construction. Among other welding achievements, they laid 2,500,000 linear feet of oil transfer lines, the majority of it welded. Today a staff of 25 welders is employed for maintenance and new construction work.

The assistant mechanical superintendent of the refinery explains and describes the welding technique employed—in the next issue of the NPN Technical Section.

Navy Salvages Fuel Oils From Tank Bottom Sludge

Valuable fuel oils are being reclaimed from tank bottom sludges by the Navy, using a method developed in their own laboratories. In two years, one plant has recovered 175,000 bbls. of fuel oils, from a total plant throughput of 450,000 bbls.

The method of treatment and recovery, and the necessary equipment will be described in detail in the April issue.

Germany's Developments In Fischer-Tropsch Synthesis

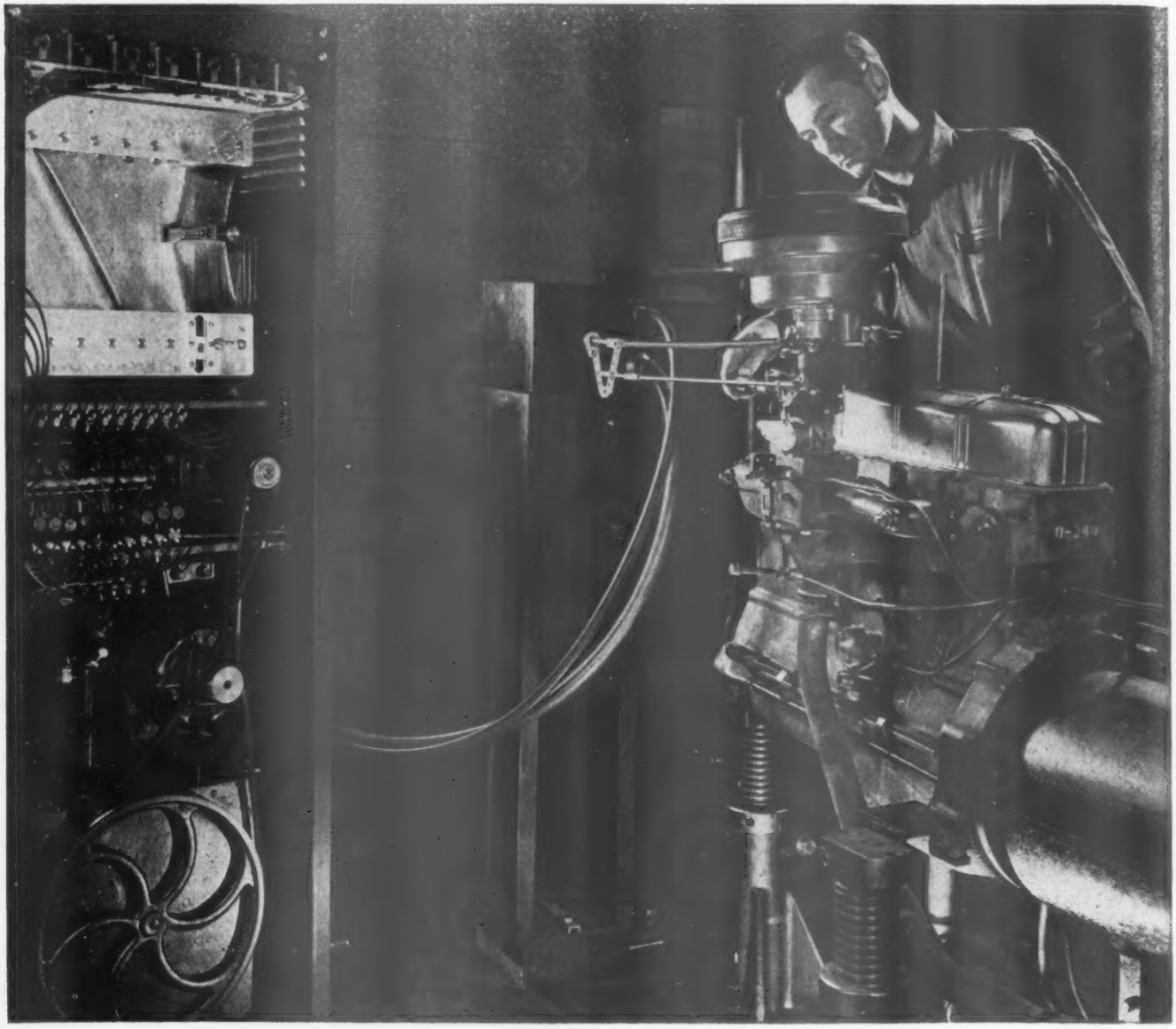
In brief, concise summary form, a member of the Technical Oil Mission which investigated Germany's petroleum industry, tells the story of that country's developments in the Fischer-Tropsch synthesis.

From the manufacture and purification of the synthesis gas, through the synthesis catalysts and reactors, down to the final reaction and products, he describes the entire process, summarizing the many reports captured in Germany and sent back to this country for study. Written expressly for NPN Technical Section readers, and appearing exclusively in the April issue.

Low-Cost Removal Of Salt from Crude

Close attention to the control of several variable factors has enabled one 3000 b/d refinery to secure 90% or better salt removal—and at a cost for chemicals of less than 20c per 100 bbls. of crude handled.

The important factors which must be watched and how they are controlled are explained by a process engineer for the refinery in the next issue.



INDOOR HIGHWAY

EXPERIENCE has shown that data accumulated during extended operation of engines at constant speed and load are likely to be decidedly misleading with respect to performance in actual road service. In service, engines are operated under a great variety of speed and load conditions.

For this reason automatic variation of the speed and load of engines on dynamometers is customary in research conducted at the Ethyl Corporation laboratories on projects having to do with the operation of automotive engines over long periods.

The apparatus shown above, which was developed in the Ethyl laboratories, is for all practical purposes an "indoor highway." It can duplicate almost exactly, and in proper sequence, all the conditions of speed and load which an engine would undergo in a full day of road service. Operating on the same principle as a player-piano, it employs a punched tape and a pneumatic system which control both dynamometer and engine to reproduce road conditions.

This "indoor highway" is only one of a number of types of apparatus used to secure automatic speed and load variations in dynamometer tests. Considerably simpler cycling control devices also are used where a less versatile control will prove satisfactory.

The research laboratories of the Ethyl Corporation and their equipment are designed specifically for research on the interrelated problems of gasoline engines, fuels and lubricants. Technical people who are interested in such problems are cordially invited to inspect the laboratory facilities, and to discuss matters of mutual interest with our research staff. Ethyl Corporation, Chrysler Building, New York 17, N. Y.

ETHYL CORPORATION

research laboratories

1600 West Eight Mile Road, Detroit 20, Michigan

2600 Cajon Road, San Bernardino, California

REFINERY MANAGEMENT *and* PETROLEUM CHEMICAL TECHNOLOGY

April 3, 1946
Volume 38
Number 14

MONTHLY TECHNICAL SECTION OF NATIONAL PETROLEUM NEWS *incorporating International Petroleum Technology*

STAINLESS STEELS

New Type Chromium-Nickel Alloy Offers Wider Range of Refinery Applications

By John S. Ewing

Economies in refinery construction and maintenance are possible through wartime advances in steel making. One important new steel, recently announced, is "Stainless W", a chromium-nickel alloy with the corrosion resistance of 18-8, yet capable of being fabricated and subsequently hardened by heat treatment. Its spot welding characteristics are approximately those of 18-8. This steel is expected to find its use in valves, pump rods and pump bodies and other applications now under test by refinery engineering departments.

Wider use in refineries and gasoline plants generally is likely to result from improvements in the design of stainless steel bubble caps. These keep the weight of the equipment to a minimum while resistance to corrosion and the toughness of the metal greatly decrease breakage. Improved methods also are now in use for applying stainless steel linings to vessels, and overlays to exposed steel surfaces, for corrosion protection.

Fitting up a stainless steel bubble tray

WHILE many war-born steels, such as the "N E" series of alloy steels, have been well known, little has yet been said about a new type of stainless steel that promises to play an important role in the oil refining industry.

Prior to World War II, the need had been indicated for a steel with the corrosion resistance of the 18-8 type but capable of developing higher hardnesses and physical properties than are found in an annealed austenitic steel. This need was partially filled by the high tensile 18-8 but the development of the properties of this steel was through the medium of cold working a modified 18-8. This method could only be applied to a limited range of steel products such as sheets, light plates, etc. Fabrication was limited to bending, machining and spot welding if the high physical properties were to be retained. The cold worked 18-8 is not an engineering alloy amenable to the full range of fabrication and subsequent heat treatment to develop physical properties. It cannot be forged and retain its high strength characteristics nor is it available in heavy bar sections capable of being machined.

To fill this gap, there was under development at that time a stainless steel which would be available in bars, billets, forgings and heavy plates, could undergo normal fabricating operations such as forging and machining, and subsequently be heat treated to develop high hardnesses and physical properties. At the outbreak of the war it was still in the laboratory stages. Due to its revolutionary nature, this product, "Stainless W," was placed under secrecy re-

Presented before the Western Petroleum Refiners Assn., Fort Worth, Texas, March 26, 1946, under the title "Stainless Steel in the Petroleum Industry."

John S. Ewing is with the Stainless Steel Division, Carnegie-Illinois Steel Corp., United States Steel Corp. subsidiary.

strictions which have only recently been lifted. Incidentally, the "W" does not refer to tungsten but rather to the plant, Wood Works, at which it was developed.

The war applications for which Stainless W was used were of a very limited nature. As a result, one of the most important factors in developing a new steel was, of necessity, omitted. We were unable to submit it to selected types of industry in order to gain a background of its actual capabilities under various operating conditions. The oil industry has many applications for a steel with the corrosion resistance of 18-8 yet capable of being hardened by heat treatment, as for example, in valves, pump rods and pump bodies. We can at present only give you a description of the steel, its properties and the results of meager fabricating experience. Experimental work, however, is being actively conducted and preliminary results are highly encouraging.

Stainless W Is Magnetic

The composition range of Stainless W is approximately 0.07 carbon, 17% chromium, 7% nickel, 0.70 titanium and 0.20 aluminum. The other elements are present in normal amounts found in other steels. It is a precipitation hardening steel. Unlike normal 18-8, Stainless W is magnetic.

Certain of the physical properties, which are more directly dependent upon metallographic structure than upon chemical composition, approach those of ferritic 17 chrome. Examples are: Specific gravity, coefficient of thermal expansion and electrical resistivity. The difference in electrical resistance and thermal conductivity between the annealed and aged conditions of Stainless W is believed to be indicative of precipitation. The constant modulus of elasticity of Stainless W, as compared with the decreasing modulus of cold worked 18-8, is significant.

Stainless W, like other precipitation hardening materials, is best treated in two steps: (1) Solution Annealing: Heating to put the precipitation hardening constituents into solid solution in austenite, which upon cooling to room temperature transforms into ferrite, which is then supersaturated with the precipitation hardening constituent. (2) Aging (Precipitation Hardening): Reheating, upon completion of austenite transformation, to a temperature at which precipitation hardening constituents will precipitate out of the supersaturated ferrite and impart the desired change of properties.

The solution annealing temperature range for Stainless W begins at about 1200°F., which is 100-200°F. above the temperature at which the material begins to transform to austenite, and extends to approximately 2000°F. With increasing solution annealing temperatures, the hardness and yield strength of the unaged material increases slightly and passes over a peak at about 1700-2000°F., while the corresponding tensile strength simultaneously reaches a minimum value at about 1600°F. and then increases slightly with increasing temperature. Usually the minimum holding time at temperature is short, and on thin sections 5 minutes at the higher annealing temperatures (1850-1950°F.) has been found satisfactory, while slightly longer times are recommended for heavier sections where it is more difficult to determine when the material has reached temperature.

On cooling, the rate of transformation of austenite to ferrite is inherently sluggish, and therefore care must be taken to be certain that transformation is essentially complete prior to aging. Two to four hours at room temperature following the 1700-2000°F. solution anneal is usually considered sufficient, but longer times are necessary following the lower solution annealing temperatures. The transformation may be followed by a series of hardness readings taken over a period of time.

Precipitation hardnening takes place over the temperature range of 500°F. to approximately 1050°F. At the lower temperatures the aging reaction is slow and resultant material lacks ductility. Of the three recommended aging temperatures, 950°F. gives the maximum tensile and yield strengths, but the lowest impact strength and ductility; while 1000°F. gives a slightly lower tensile and yield strength with an improved impact strength and ductility. Aging at 1050°F. results in the formation of some austenite which improves the ductility and impact strength but at some sacrifice of tensile and yield strengths. The heating rate to the aging temperature does not have an appreciable effect upon the resultant mechanical properties, but the cooling rate from the aging temperature has a very pronounced effect upon the impact strength, which is markedly improved by rapid cooling.

Has Extreme Uniformity of Hardness

One of the most interesting characteristics of Stainless W is the extreme uniformity of hardness, in both the unaged and aged conditions, obtainable over the cross section of bars of various diameters.

Stainless W in the solution annealed condition will show mechanical properties of the order of 125,000 lbs. tensile strength, 100,000 lbs. yield strength, 8% elongation in 2 ins. and a hardness of approximately 25 Rockwell C. Depending upon the aging temperature, mechanical properties can be obtained in the neighborhood of 200,000 lbs. tensile strength, 175,000 lbs. yield strength, 8% elongation and a Rockwell hardness of 40C. Complete information regarding the full range of properties is available on request.

Stainless steel bubble trays are light and easy to handle

The Izod impact strength of Stainless W in the unaged condition is approximately 40-60 foot pounds, regardless of the solution annealing temperature. Upon aging, however, the solution anneal prior to aging and the cooling rate from the aging temperature will have a bearing upon the resultant impact strength with the faster cooling rates favoring better impact properties.

The endurance ratio for the unnotched specimens is approximately 0.46 based on a tensile strength of 195,000 psi, and approximately 0.20 for the notched condition. Results of other tests indicate the unnotched value to be, conservatively, about 96,000 psi for aged material.

At temperatures above 800°F. the strength of Stainless W is about the same as that of annealed 18-8. However, at moderate temperatures, the strength imparted to Stainless W by the precipitation hardening process is maintained and may be utilized.

Standard embrittlement tests show that Stainless W is not susceptible to intergranular corrosion. Likewise, the metal resists the salt spray test about as well as standard 18-8. When immersed in sea water, no appreciable difference in corrosive attack was observable between the annealed 18-8 and 18-8 Ti controls and the Stainless W in either the solution annealed or aged conditions. After 3.5 years of exposure, it appears that Stainless W has approximately the same resistance to atmospheric corrosion as does 18-8. A limited amount of primary data from service and simulated service tests on Stainless W valve parts in hydrogen sulphide gas, sulphur dioxide gas, and hot milk, indicates corrosion resistance equivalent to the 18-8 types of stainless steels in many media.

There are indications that the steel

can be machined in about the same manner as the free machining 18-8 although there is not much information as yet available on tool life. The forging characteristics of the material are similar to those of the normal 18-8. The mechanical properties of Stainless W in the solution annealed condition are such that it will not withstand extreme cold deformation.

The spot welding characteristics of Stainless W are approximately those of 18-8, which are excellent.

Since the properties of Stainless W are a function of the chemical composition and heat treatment, the properties of welded joints will also depend upon these variables. The problem of depositing weld metal of chemical composition similar to that of the parent metal, particularly with respect to titanium, was solved by the development of suitable flux coating for Stainless W core wire. The special electrodes were subjected to a number of welding tests and show that:

1. The "as-welded" strength of joints in solution-annealed sheets and plates is about the same as that of the un-welded material, i.e., 100% efficiency.
2. The "as-welded" strength of the joints in aged sheets and plates is about 70 to 80% of that of the unwelded material.
3. The strength of joints given post heat treatment of aging only, was erratic, particularly on specimens on which the weld bends were not ground flush, and varied from the strength value of solution annealed material to that of fully aged material.
4. Solution annealing and aging after welding produced strengths across the welded joints exceeding 90% of the strength of fully aged parent metal. The hardness values show that the heat resulting from the deposition of the second bead has an effect on the aging response of the first bead.

Other Welding Methods Being Studied

In general, the results are very favorable and show that Stainless W can be readily joined by the process of metal arc welding and high joint efficiencies obtained, particularly when solution annealing followed by aging is employed as a post welding heat treatment. Further work on the aging characteristics of single and multipass welds is now in progress. Welding by means of the atomic hydrogen and heli-arc methods is now being investigated and preliminary results have been successful.

There is every indication that Stainless W can be utilized to advantage by the oil refinery industry. The material is available at the present time in all of the normal wrought forms and test samples can be furnished for investigation.

Prior to 1942, the oil refining industry as a whole was very active in its demands on the steel industry for steels to meet various operating conditions. Much of the testing of new steels by your companies had to be omitted during the ensuing four years. I do not believe it would be amiss to review briefly some of the applications which were meeting with success prior to the war period.

Economical protection against corrosion in reaction chambers, flash towers, evaporators, coking drums, vacuum towers, bubble towers and heat exchangers may be obtained by applying thin sheets or strips of stainless steel to the inner surfaces of the units, the material being applied either in the shop or in the field as may be most suitable. Under ordinary conditions in Hot End service, 12% chromium steel will provide adequate protection to the equipment, but where exceptionally severe conditions exist, the 18-8 or 18-8 Mo types should be used.

Linings Also Provide Insulation

Stainless steel linings serve to insulate the shells to some extent and thus aid in preventing distortion or cracking when the vessels are being cooled rapidly. This action serves to cut down the time "off stream" and in many cases is, in itself, a sufficient reason for the application of stainless steel liners.

More and more stainless and heat resisting steel is being used for refinery valves and trim. Martensitic stainless steel, such as the 12% chromium type, which can be hardened by heat treatment, finds extensive use in Hot End applications where corrosion conditions are not too severe. Many operators, however, prefer to use the same type of equipment throughout the plant, and as a result, must use a steel that will stand up under the attack of Cold End corrosive products. For such use, the austenitic type 18-8 chromium-nickel steels are giving very satisfactory results in valve trim. The long life of such valves in Hot End service and the convenience and economy of maintaining a smaller stock of replacements frequently justifies the somewhat higher prices of the valves made of the more corrosion resistant steel. It is quite possible that the new Stainless W will find important applications in this field.

The experience gained in other fields has made it possible to fabricate stainless steel bubble trays economically and, consequently, they can be used for most types of high temperature service instead of being restricted for use only in those applications where severe corrosive conditions are encountered. Good design holds weight to a minimum while the corrosion resistance of the metal minimizes attack and its toughness holds breakage to a point sufficiently low to not interfere with the economic operation of the unit.

When stainless steel is used for bubble tray construction, experience shows that the towers can be put on stream or cooled down for cleanout and inspection more quickly. Being lighter in weight, stainless steel trays have less heat capacity than cast-iron trays, thus making it possible to change temperatures without the delay normally attendant upon "circulation" to adjust temperatures.

Hot End applications, where temperatures range from 400° to 1000°F., may ordinarily be handled with 12% chromium stainless steel, which has sufficient corrosion resistance to meet the conditions encountered where liquid water is absent. Strip tests, however, are recommended for Cold End applications to make sure that the steel selected will have sufficient corrosion resistance to meet the specific conditions encountered and at the same time possess the other properties necessary for proper service.

Because of their light weight, stainless steel bubble caps have been widely used in natural gasoline plants handling sour gases, in absorbers and stabilizers, and in crude, vacuum and pressure distillate (cracking) bubble towers. They are easily fabricated because of the tough and ductile character of the metal and sharper fractionation is more easily attained because there is little or no danger of towers being operated with caps having broken teeth.

Stainless steel bubble caps are not normally susceptible to coking through corrosive action. Consequently, towers are "on stream" longer; "down time" for cleaning is shorter; less labor is involved. Inasmuch as in towers equipped with stainless bubble caps, which are free from fouling, pressure drop remains constant, a better production and better operation result.

Small Trays Possible

More caps per tray, or a smaller tray containing the same number of caps, can be installed when stainless steel is used for the bubble caps. Being extremely thin and easily punched, stainless steel bubble caps can be made with more teeth, which aids in securing a more intimate mixture of the vapor and the liquid on the tray.

Pump rods are now being made of 18-8 stainless steel because of its toughness and resistance to corrosion. Heat-treated 12% chromium steel finds a useful place as impeller shafts for centrifugal pumps because of its desirable combination of hardness and satisfactory corrosion resistance. Plungers in hot oil pumps handling corrosive stocks have been made successfully of both 5% chromium-molybdenum steel and of 18-8 stainless steel, the choice depending upon the degree of corrosive action of the stock being pumped. In many instances it has been found economical

to make the entire pump body of stainless steel.

Exposed steel surfaces can be protected economically by the application of weld overlays, using 18-8 or 25-20 stainless steel welding rods. Such overlays not only guard the base metal against corrosive attack, but also protect it against erosion or washing action that may give trouble with the softer, less corrosion-resistant metals.

Other Uses of Weld Overlays

Other effective and economical applications of weld overlays include building up corroded, eroded, or wire-cut bodies of control or flow valves; facing flanges or building up the bonnets of valves; and lining spools, vapor line ends, junction boxes, headers, plugs and return bends. Hot oil pumps have been successfully built up by welding, as have plugs and bodies of plug cocks. Check valve bodies, and application inside the stainless trim on gate valves also afford other opportunities to take advantage of the economies which are possible through the use of stainless steel weld overlays.

It is impossible to list all the important applications of corrosion and heat resisting steels. The principal applications have been outlined above, but there are a host of other important, yet relatively minor, applications of stainless steel around the Hot End of any refinery. For example, the 12% chromium and 18-8 stainless steels are now being used for liners in towers, nozzles, gaskets and orifice plates. Thermocouple wells and ball floats fabricated from 18-8 stainless steel have given good results in service. Tube sheets, baffles, supports and spacers for heat exchanger bundles in many refineries are now being made from 5% chromium steel, 12% chromium steel, and 18-8 stainless steel according to the specific needs. When corrosive stocks have to be handled through heat exchangers, operators report good service from 5% chromium-molybdenum and 18-8 stainless steel tubes. Other miscellaneous applications include tray support angles, rain decks and baffles in bubble towers and evaporators.

Stainless and heat resisting steels can be applied to good advantage in connection with furnace dampers, high temperature air preheaters and gas recirculating systems, the type of steel to be used depending upon the conditions involved, including both temperature and degree of corrosive action possible.

Cold End Applications

Under varying conditions, all the stainless and heat resisting steels, including the 5% chromium-molybdenum type, have given economical service in Cold End refinery applications. Straight chromium steels, however, must be used with discretion when there is the possibility of hydrochloric acid being produced by the hydrolysis of salts such as magnesium chloride during the thermal treatment of the stock, or when SO_2 or SO_3 is present. An economic study of the whole problem should always be made, for the economy possible when the 5% chromium-molybdenum or the 12 or 17% straight chromium steels can be used is worth gaining, if possible. These steels have demonstrated their value in many instances where Cold End corrosive action was not too severe.

Type 316 Stainless steel, which contains approximately 2 to 3% of molybdenum in addition to 18% chromium and 8% nickel, has given satisfaction in Cold End service. This type of stainless steel shows a corrosion resistance at all times equal to that of the usual 18-8 stainless steel and where acids such as dilute hydrochloric, sulphuric, sulphurous, wet hydrogen sulphide, or phosphoric, as well as a wide group of the organic acids, are present, its appreciably greater corrosion resistance proves valuable. Trial installations have been highly successful and consequently the use of 18-8 Mo type of stainless steel is increasing rapidly in refinery applications.

Vacuum and pressure relief valves on storage tanks must function smoothly at all times for best results. Use of 18-8 stainless steel in these valves and seats will assure a smooth, dense surface and a perfect fit between the valve disc and the seat, thus making smooth operation of these important valves more certain.

No Steel Solves All Problems

No single type of stainless steel should be considered as a cure-all for all the corrosion or high temperature problems encountered in refinery operation. Each of the several types and grades now available has a place and the application of the right grade to the particular situation is a technical problem which must be considered from all angles. The final answer lies in attaining an economic balance between cost and operational efficiency. Technical advice should be sought from refinery chemists and operators in conjunction with the experience of the engineers and metallurgists whose services are offered by the companies making stainless steel. Their experience can safely be relied upon, for they have been confronted by corrosion and oxidation problems in many different guises and what may appear to be a major problem may often be solved by utilizing the information gained in solving a similar problem which was not so important in another plant, yet which had to be solved for fully satisfactory results of the installation as a whole. Information of that kind cannot be assembled into standard recommendations as there are so many complicating factors.

In closing, it should be reiterated that in many cases new steels result from a demand by industry. Applications of old or new steels can only result from your making known to the steel manufacturer your requirements.

Field Lining with stainless steel extends the life of refinery towers and other vessels requiring resistance to corrosion

Tomorrow . . . IN PETROLEUM TECHNOLOGY

Preview of What's Ahead . . . Based on Today's Technological and Economic Developments

Technical and economic developments which have a direct bearing upon the future of petroleum refining operations are discussed in this series. Topics projected this month include: discussion of required changes in the octane number and related systems; the use of hydrogenation for the upgrading of catalytic cracking cycle stocks; information on hydroforming catalysts; and comments and related information on the recent list of Synthine patents available from the Alien Property Custodian.

Also included are comments on an excellent new booklet on hydrogen; an analysis of trends in coal chemical research; comments on ethylene, the fundamental aliphatic synthesis "brick"; and a report on Cuban use of power alcohol.

Octane Number System Undergoes Review

It is no secret within the petroleum industry that the prewar system of octane numbers was severely "strained" when used to measure the high-quality aviation fuels developed during the war and that variations had to be improvised to meet the situation. It is more than unfortunate, however, that there seems to be no easy way to explain these variations and certain entirely new systems, based on reference fuels other than isooctane, to a public which has not yet clearly grasped the meaning of normal octane numbers, even though thoroughly "sold" on the differential existent between commercial grades of gasoline.

Thus the Grade 100/130 aviation gasoline currently used by the armed forces has been frequently reported in the popular press as "130-octane" gasoline, while fuels of "145-octane" and above have also been mentioned. A recent review on wartime developments in reference fuel scales for knock rating[1] does much to dispel the seeming mysteries involved, but, of necessity, on such a technical plane that not much can be interpreted for popular dissemination—chiefly because several systems are involved.

The octane number system itself is still sufficiently complex that explanatory papers continue to appear concerning it.[2] The existence of two octane number systems, the CFR Research and the ASTM or CFR Motor methods, is conducive to confusion unless the user keeps definitions clearly in mind.

So complex a subject is well beyond the space limitations of this series and will be considered in a later article in the NPN Technical Section. The importance of the use of a uniform quality system, or at least a well-integrated series of systems, is well understood by both the automotive and petroleum industries. It is one of the attendent phases of the growing complexity of petroleum operations that "simple" yardsticks often become inadequate. The public benefits greatly from the better products and lower prices which technical advances entail, but it will be well to remember that their grasp of details can never be quite complete and that any new gasoline quality system must be uniformly adopted and ready for explanation if it is to gain popular acceptance.

Hydrogenation of Catalytic Cracking Cycle Stocks

A recent paper on the hydrogenation of cycle stocks from catalytic cracking[3] serves again to call to attention the potential versatility of hydrogenation processes, destructive and otherwise. As mentioned last year,[4] these processes are highly developed and technically excellent, and if crude oil prices increase appreciably in the next few years they will probably be widely applied.

The present paper deals in some detail with the use of either high or low pressure "hydrogenation of the aromatic constituents in refractory, catalytically-cracked, cycle stocks to their corresponding naphthene derivatives," resulting in "improved catalytic-cracking feed stocks which are superior even to the original gas oils."

Higher conversions are obtained, less carbon is deposited on the catalyst, and the octane numbers of the resulting gasolines "are at least as good as those obtained with virgin feed stocks." Extensive desulfurization is also accomplished, and, if desired, "excellent Diesel fuels can be prepared from very poor material," although "the broadest field in the future for the saturative hydrogenation of gas oils may be in the upgrading of catalytically cracked cycle stocks for further catalytic cracking."

Space does not permit an account of the technical details involved. It must suffice to note that the economics of the simple, high-pressure catalytic hydrogenation "will obviously depend to a large extent on the differential in value between the virgin charging stock and the by-product cycle stock.

"Low pressure hydrogenation, which is cheaper than high pressure, can do an intermediate job on the hydrogenation of cycle stocks and can do a rather complete job on their desulfurization.°°° The choice between low pressure and high pressure hydrogenation will depend on local situations and the general price structure for petroleum and its products, which hinges on the cost and scarcity of crude oil and the relation of coal and fuel oil prices."

"As a means of conserving petroleum supplies from a standpoint of national policy, the hydrogenation of catalytically cracked cycle stocks should command thoughtful attention."

Hydroforming Catalyst Composition Revealed

Technical information is often obtained in exceedingly devious ways. A good example of this is the information on the constitution of 290,700 pounds of hydroforming catalyst

(1) Brooks, D. B., *Petroleum Refiner* 25, No. 1, 130 (1946), "A Review of the Development of Reference Fuel Scales for Knock Rating."

(2) Best, H. W., *Automotive and Aviation Industries* 94, No. 5, 32 (1946), "Why Octane Number Does Not Always Represent the True Antiknock Value of a Gasoline."

(3) Brown, C. L.; Voorhies, A., Jr.; and Smith, W. M., *Industrial and Engineering Chemistry* 38, No. 2, 136 (1946), "Cycle Stocks from Catalytic Cracking —Hydrogenation and Desulfurization."

(4) Anon., NATIONAL PETROLEUM NEWS, *Technical Section*, 37, No. 36, R-742 (1945), "Keeping Up With the News —Petroleum Hydrogenation."

which the War Assets Corporation is advertising for sale.

According to this advertisement, this catalyst consists of molybdena deposited upon alumina, as follows:

Molybdena content, minimum (moisture free basis)	8.5%
Moisture content (as determined by loss in weight on drying for 1 hour at 1200° F.), maximum	5.0%
Chloride content, maximum	0.15%
Soda content, Na_2O	0.1%

The catalyst in question is stored in a Texas City, Texas, warehouse, so it might be assumed that it was originally intended for use in the Baytown Ordance Works, which was operated by Humble during the war and which was recently purchased by that company from the RFC for $6,948,000; it was built at a cost of $13,292,000. It is not explained why Humble did not desire to acquire the catalyst along with the plant.

Whatever the case, it is interesting to learn the composition of a catalyst which was actually used in hydroforming operations. This process is a very interesting one[5] and worthy of continued attention.

Alien Property Custodian Lists Available Synthine Patents

A recent list prepared by the Alien Property Custodian is of interest for a number of reasons. First of all, it lists the "Fischer-Tropsch synthetic fuel patents" which the Custodian has available for nonexclusive license. Surprisingly enough, this list is so short that it may be included here; U.S. patents 1,746,464; 2,110,240-1; 2,127,127; 2,149,515; 2,206,500; 2,219,042; 2,225,487; 2,238,726; 2,238,766; 2 243,760; 2,243,897; 2,257,457; 2,261,184; 2,278,644; 2,289,731; 2,330,750; 2,339,927; 2,332,887; and 2,368,939.

Licenses are also available on patent applications of the following serial numbers: 146,125; 153,532; 163,532; 280,054-5; 306,026; 368,088; 373,055; 374,770; 389,691; 390,996; 414,926; and 417,495-6.

The size of this list has apparently been materially affected by the recent court decision[6] which restored to Standard of New Jersey those patent rights which it had obtained from German interests prior to the war. A somewhat more inclusive list prepared in February of last year by this writer showed that 186 pertinent patents assigned to various companies and individuals had been seized by the Custodian, and 13 patents had so far issued (by forced assignment) directly to him. Some 24 patent applications were then available for license, also.

In checking the above list, one at-present-unexplained fact may be noted: 11 of the patents were originally assigned to the Hydrocarbon Synthesis Corp., a group which (according to testimony given by Bruce K. Brown at Senate subcommittee hearings on S. 1243) "was a company that was organized to develop the Fischer-Tropsch process and certain allied processes in the U. S. Among the interested companies were the Jersey group, the Shell group, and M. W. Kellogg Co." Mr. Brown was unable to testify at that time (1943) as to whether or not the group had been dissolved.

It would be interesting to learn why these patents were seized and why they (and related applications) remain on the Custodian's list. Incidentally, it would also be interesting to determine why U. S. 2,215,885, the only other identified (by the writer) patent issued to the Hydrocarbon Synthesis Corp. (on cobalt recovery from spent catalysts) is not on the Custodian's list. A further oddity is the fact that none of these patents were listed as owned by the Custodian in a master index issued in May, 1944.

It might be pertinent to note that, as of February, 1945, the writer had identified 713 U. S. patents as pertinent to the Synthine and related processes. Of these, 146 deal with the preparation of synthesis gas from hydrocarbon and steam, etc.; 132 with the preparation of synthesis gas from water gas; 74 with the purification of synthesis gas; 123 with the catalytic synthesis to hydrocarbons; 65 catalytic synthesis of oxygenated compounds; 10 with catalysts for synthesis gas production; 34 with catalysts for hydrocarbon production; 24 with catalysts for the production of oxygenated compounds; 96 with apparatus for synthesis gas production (91 by the water gas reaction); 6 with apparatus for the catalytic synthesis of hydrocarbons; and 3 with apparatus for the catalytic synthesis of oxygenated compounds. Much of this classification had to be arbitrary, but it is at least indicative.

By far the dominant position would seem to be held by the Jersey Standard group, if it actually holds the 76 patents issued to I. G. Farbenindustrie in addition to its own 64 and possibly those assigned to other companies and individuals. How many of these are involved in the consent decree entered into by Jersey on March 25, 1942, however, is a matter which requires checking. Other than Jersey and the Hydrocarbon Synthesis Corp. (now held by the Custodian), no one company controls 10 pertinent patents.

Hydrogen Processes Discussed in Booklet

One of the outstanding phases of modern technical advertising is the practice of issuing authoritative booklets which describe an entire field in addition to calling attenion to the product or process in question. Such bulletins are a valuable part of any file, since they often contain information not elsewhere available in such a useable form.

A recent publication on hydrogen[7] is an excellent example of this type of bulletin and is particularly timely in that demands for hydrogen are likely to increase following a possible diminution occasioned by the elimination of wartime uses. A valuable Government release on this subject was discussed last year.[8]

Processes discussed by Girdler include:

(1) The hydrocarbon-steam process, in which pure hydrogen may be produced by reacting such hydrocarbons as propane with steam at such elevated temperatures as 1500°F., thereby converting the hydrocarbons almost completely to hydrogen and carbon oxides. The carbon monoxide is further catalytically reacted with steam to yield carbon dioxide which, according to the Girdler process described, may be removed by scrubbing with amine solutions. Hydrogen of 99.97% purity can be obtained by successive purification steps.

(2) The water gas reaction, which is similar to the second step in the above process in that the carbon monoxide in water gas is converted catalytically into carbon monoxide by reaction with steam, then removed. This process is recommended "in locations where hydrocarbons are not readily available."

(3) The iron-steam process, in which "hydrogen is produced by passing steam over hot iron ore which has been previously reduced by a gas such as water gas.°°° High purity hydrogen may be obtained by suitable purification."

(4) The catalytic reaction of methanol (wood alcohol) with steam. The raw material, methanol, is relatively expensive, but equipment costs are low, and the process was used in portable wartime installations.

(5) The production of hydrogen (and oxygen) by the electrolysis of water, particularly useful where electricity is cheap, where there is a demand for both gases, in small plants,

(5) Anon., NATIONAL PETROLEUM NEWS, *Technical Section*, 37, No. 1, R-44 (1944), "Keeping Up With the News —Toluene by Hydroforming."

(6) Anon., NATIONAL PETROLEUM NEWS, *Technical Section*, 38, No. 6, R-91 (1946), "Tomorrow in Petroleum Technology—Jersey Standard Retains Important I.G. Patents."

(7) Anon., *Hydrogen*, The Girdler Corporation (Louisville, Ky.), 1946.

(8) Anon., NATIONAL PETROLEUM NEWS, *Technical Section*, 37, No. 14, R-292 (1945), "Keeping Up With the News —Hydrogen."

or where carbon-compound-free hydrogen is essential.

(6) Miscellaneous processes such as "the thermal dissociation of hydrocarbons to produce hydrogen and carbon black, the catalytic decomposition of ammonia, and the reaction between ferrosilicon and caustic soda." Hydrogen is also obtained as a byproduct in such processes as catalytic dehydrogenation.

The bulletin contains many process details, including a description of the Girbitol process for separating acidic gases from gases and liquids by contact with solutions of amines. Hydrogen purification processes such as methanation, treatment with cuprous salt solutions, water scrubbing, dehydration, deoxidation, and liquefaction are mentioned; hydrogen synthesis catalysts for the first process are described; and mention is made of methods of analysis, properties, and other useful information.

Reference is made to the fact, previously described,[8] that the hydrocarbon-steam reaction can be used to give "special gases and gas mixtures" for use in synthetic gasoline manufacture (the Synthine process), ammonia synthesis, methol synthesis, etc.

Hydrogen and hydrogen-containing gases will be in large demand for many industrial purposes. The patent structure involved in such processes as the hydrocarbon-steam method (often called the "methane-steam" process in a too limiting sense) is not particularly clear, but this process is now dominant for large-scale use, although partial oxidation methods (not mentioned in this booklet) may eventually challenge it, at least for the Synthine process.[9] It is interesting to note, however, that the Girdler Corp. was recently given the contract to build a plant with a capacity of 110,000 cu. ft. of hydrogen and 120,000 cu. ft. of synthesis gas daily at the Bureau of Mines' new synthetic fuel laboratory at Bruceton, Pa. "The contract price does not include licenses or immunities under certain patents held by the Hercules Powder Co., the Standard Catalytic Co., and the Girdler Corp."[10] other companies also hold patents on hydrogen synthesis.

Trends in Coal Chemical Research

Although it is now contributing much to the production of chemicals, the petroleum industry will do well to keep an eye on developments in the field of coal chemical research. It is not wise to assume that progress there has by any means ceased, despite the age of the industry and its (present) general limitation to the status of a by-product field (coke being the major product.)

A recent paper on coal chemical research[11] reveals the fact that this industry is well aware of its limitations and potentialities. According to the author, "the coal chemical industry can help to strengthen its position by aggressive and organized research along the following lines: (1) Development of new or improved methods for recovery of individual products from the tar more efficiently and at lower costs, (2) increase in the qualities of existing tar products, and (3) development of uses for the tar compounds or fractions, either new and broader applications for the products themselves or synthesis from them of derivatives which can find application in industry."

Many coal chemical products compete directly with those from petroleum (or vice versa, from a historical viewpoint). Coal-tar naphthalene, for example, is the chief raw material for phthalic anhydride production, although petroleum-derived ortho-xylene is now used in at least one plant. Cresols and cresylic acids are normally derived from coal tar, although a few petroleum companies are now separating them from oil fractions. Incidentally, Wilson mentions that a method of separating the isomeric cresols—by converting them to butylphenols, separating the latter by distillation, and then dealkylating to yield the original but pure cresols—was developed by "one petroleum refiner" (Gulf) and is the "sort of thing the coal chemical industries could well be doing for themselves."

Benzene, toluene, cyclopentadiene, organic sulfur compounds—these and many others substances can come from either coal or petroleum. In addition, the author mentions the European practice of separating coke oven gas into its major constituents—hydrogen, methane, the paraffins, and the olefins—by progressive liquefaction and fractionation. This method has not been much used in this country, because of economics, but it is at least indicative of possibilities. In pointing to the potential markets involved, Wilson mentions that "production of hydrogen in the U. S. is reported to be about five billion cubic feet per month," about three billion of which is used for the production of synthetic ammonia (chiefly from petroleum-derived hydrogen, incidentally).

Wilson mentions that "fundamental information on the nature of coals would eventually permit modifications in processes of coal carbonization or coal treatment which would affect the whole coal chemical field profoundly." So also, would commercial application of chlorination and similar direct chemical reactions; reaction (of coke) with steam has already yielded intermediates (water gas) for many chemical products.

The vast field of petroleum chemicals has resulted from the great diversity of the raw materials available in petroleum and natural gas and their utility in producing intermediates for still other chemical products (where still further competition with coal chemicals occurs). It is somewhat ironical to note, however, that coal reserves are incomparably greater than those of petroleum and that these same "petroleum" chemicals may some day be derived from synthetic petroleum obtained from coal itself.

Power Alcohol Reported Inefficient

According to a recent news item, Cuban motorists are reported to be dissatisfied with their present motor fuel, carburante nacional, which is a wartime-adopted blend of two-thirds alcohol and one-third gasoline.

Cubans complain that the fuel is inefficient and injurious to their motors. Nevertheless, President San Martin and his cabinet have decreed that its use is obligatory, and this presidential order is expected to remain in effect until "permanent protection" is provided for the Cuban alcohol industry.

Even though carburante nacional is not subject to the island's gasoline tax, 17c per gallon, it is said to sell at the higher price of 40c. Why this price should be so high is not particularly clear, since the cost of producing alcohol from local blackstrap molasses, even at wartime prices, is not that great.

The petroleum industry must keep a weather eye open for signs of unwarranted attempts to force the uneconomic use of power alcohol, either alone or in blends. This Cuban report, technically accurate or not as to fuel efficiency and utility, is an excellent example of what might happen if power alcohol were legislated into use in this country also. Once established on an expanded basis, as was the wartime Cuban alcohol industry, it is highly likely that an uneconomic "alky-gas" industry here, too, would require "permanent protection."

And there are groups and interests in this country who are ardent proponents of alcohol as fuel for our automobiles, buses, trucks and airplanes—by subsidy if it cannot stand on its own feet in competition with other fuels.

(9) Anon., NATIONAL PETROLEUM NEWS, *Technical Section*, 38, No. 1, R-74 (1946), "Keeping Up With the News—Synthine Developments."

(10) Anon., *Chemical and Engineering News* 24, No. 4, 486 (1946), "Bureau of Mines Liquid Fuels Program."

(11) Wilson, P. J., Jr., *Trends in Coal Chemical Research*, Paper Presented Before the Blast Furnace and Coke Association of the Chicago District, February 5, 1946.

SHOP FABRICATED TOWER

Even the Weather Played an Important Part In Getting 108-Ft. Giant Vessel into Position

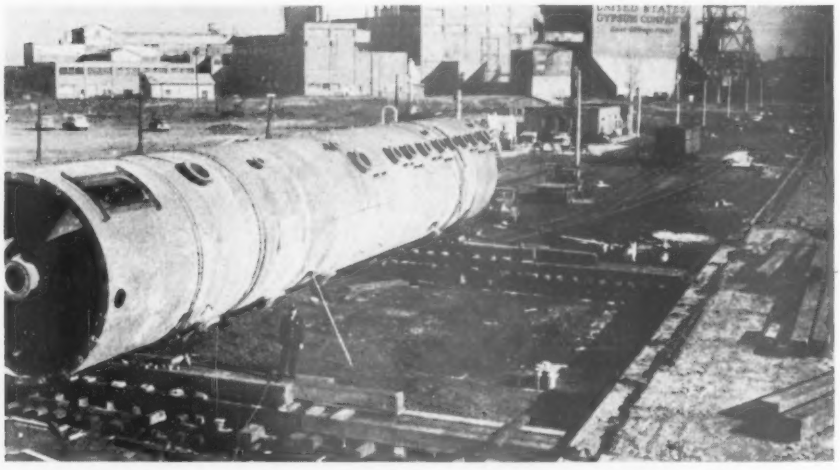


Fig. 1—The 108-ft. tower is unloaded at Whiting by skidding it from barge onto cribbing. Then it was loaded onto special flat cars and pulled to refinery site

PLANNING and designing the construction of modern large size refinery units sometimes has to take in much more than the fabrication of the vessels and their installation in the plant. As, for example, in the case of the huge fractionating tower for the Fluid catalytic cracking plant of Standard of Indiana at Whiting, one of the largest shop-fabricated vessels ever shipped to a refinery.

At the drawing board stage it was foreseen by the M. W. Kellogg Co. engineers that the size of the tower—108 ft. long, 16 ft.-2 in. diameter and 155 tons weight—would not permit its rail shipment because of limited clearance. It was necessary to utilize water transportation, and the contract for fabrication was let to A. O. Smith Corp., Milwaukee, because their shops and the refinery site at Whiting are both on the shores of Lake Michigan.

After fabrication, the vessel was skidded onto two flat cars, the floors of which had been lowered so the vessel could clear 11 bridges en route to the lake front. There it was loaded onto a barge. As the tower was not ready for shipment until near the close of the navigation season last fall it was necessary to keep in close touch with weather conditions, but the trip could not be long delayed. The lake trip was made in calm weather and required 12 hours. Twenty-four hours later bad weather had set in and within a few days the lake had frozen so that delay would have prevented shipment until navigation opened up this spring.

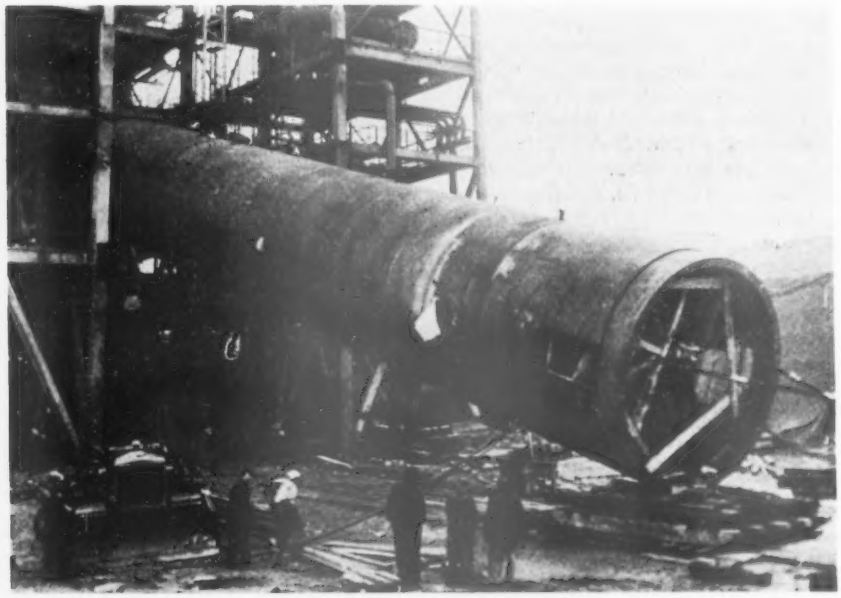


Fig. 2—At job site, tower is slid off flat cars in position to be turned through a 90 degree arc and be directly hoisted into its structure

During fabrication of the vessel a railroad spur had been built at Whiting almost to the water's edge (see Fig. 1) and terrain prepared so that the vessel could be skidded directly onto flat cars because the height of the flat cars on the track was the same as that of the cribbing. The same flat cars, bolsters and blocking were used as at Milwaukee. To facilitate operations the Kellogg boss rigger had been sent to Milwaukee to observe the loading of the tower and to check its height above water with the prepared arrangements at Whiting, which were built from calculations.

Loading the vessel onto tank cars at Whiting was accomplished with tractors and hoists. The vessel was then pulled to the job site one mile away. Here, the railroad spur had been laid so that the tower, when slid off the flat cars via inclined skids and turned through a 90 degree arc, was directly in position to be hoisted into its structure (see Fig. 2).

Since the plate thickness was only 55/64 in., a "spider" of timber bracing was built inside the tower at the point where lashing to the hoisting devices was made. This was a safety precaution to prevent crushing of the shell at this point. A Kellogg-designed 125-ton derrick and a 100-ton gin pole were used to raise the vessel into position. The derrick was mounted on a 100-ft. steel tower specially built for the erection of all the main tower structures and vessels of the Fluid unit. After use the tower, as well as the derrick, was moved to other job sites.

Very close clearances constituted a problem in lifting the tower into place because steelwork for the Fluid unit had already been erected as completely as possible. However, the upward pull employed was exceedingly slow and steady and was accomplished by two-geared heavy steel winches driven by air motors. On reaching its final position, the tower was bolted into a prepared base. A normal rigging crew of 15 men accomplished this job in five hours.

In use, the tower will process the total cracked vapors from a 20,000-bbl. Fluid catalytic cracking unit into an overhead stream of gas and 400° F. end point gasoline; light and heavy gas oil side streams; and a bottom stream consisting of heavy gas oil and suspended catalyst. The tower will be equipped with 18 pressed steel fractionating trays and 8 baffles. A stainless steel liner 7/64 in. thick was spot welded to the entire interior to give the vessel the required corrosion resistance.

Patent Trends in Petroleum Refining

By Peter J. Gaylor

Patent Attorney and Editor "The Technical Survey"

New patents disclosing a synthetic lubricant, extreme pressure lubricants, a viscosity index improver and soluble oils are abstracted and discussed in this month's review of the patent field. Also covered are methods for producing heavy metal soaps of fatty acids, for incorporating phenolic compounds in aluminum grease blends, and for manufacturing lubricating oils especially resistant to oxidation and sludge formation. Among the petrochemical patents is one describing the hydroxylation of aromatic hydrocarbons.

Lubricants

Among the **synthetic lubricants** recently disclosed in issued patents is an ester-ether mixture (Sinclair U. S. 2,395,380) having the following composition:

Tri-o-cresyl phosphate	40%
Ethylene glycol monobenzyl-ether	30%
Tri-o-butyl phosphate	30%

This product is a clear, oily liquid having a flash point above 265° F. and a cloud point below −96° F. It is claimed to have excellent load-carrying properties and its viscosity is around 500 cs. at −90° F., which would allow free and easy turning of an instrument shaft. In one test, it was possible to turn easily a shaft employing this lubricant at −112° F. Its viscosity at 100° F. is 2-3 cs. The spread factor (creeping tendency) of the oil is much less than that of petroleum oil and approaches that of many of the finest watch oils. The synthetic oil is claimed to have no corrosive action on metals or metal bearings, and it is said to be non-toxic.

In its U. S. 2,395,379, Sinclair discloses the use of **benzaldehyde as a lubricant** at low temperatures. This compound has the following properties:

Vis. at −40° F., cs.	7.66
Vis. at 0° F., cs.	3.51
Vis. at 100° F., cs.	1.13
Vis. at 200° F., cs.	0.68
Melting pt., °F.	−14.8
Flash pt., °F.	68.8
Boiling pt., °F.	354
Sp. gr.	1.0504
Index of refraction	1.54629

It may contain a small amount of extreme pressure agent and an antioxidant, preferably one which will also act as a corrosion inhibitor. Benzyl alcohol (which has a boiling point of 400° F. and density of 1.05) may be added to give it a pleasant odor.

A few per cent of benzaldehyde added to petroleum spindle oil was found to prevent seizure in the 4-ball testing machine at a load of below 600 lbs.

Pure Oil Co. has been able to produce potent **extreme pressure lubricants**, according to its U. S. 2,394,734. One product showing an SAE load test above 300 lbs. at 1000 rpm contained a major proportion of mineral oil, a small amount of sulfochlorinated and phosphorized lard oil containing not less than 2% by weight of sulfur and chlorine in stable chemical combination, and 1-3% of chlorinated aliphatic hydrocarbon boiling above 180° C. and having over 85% by weight of chlorine, the combined amount of sul-

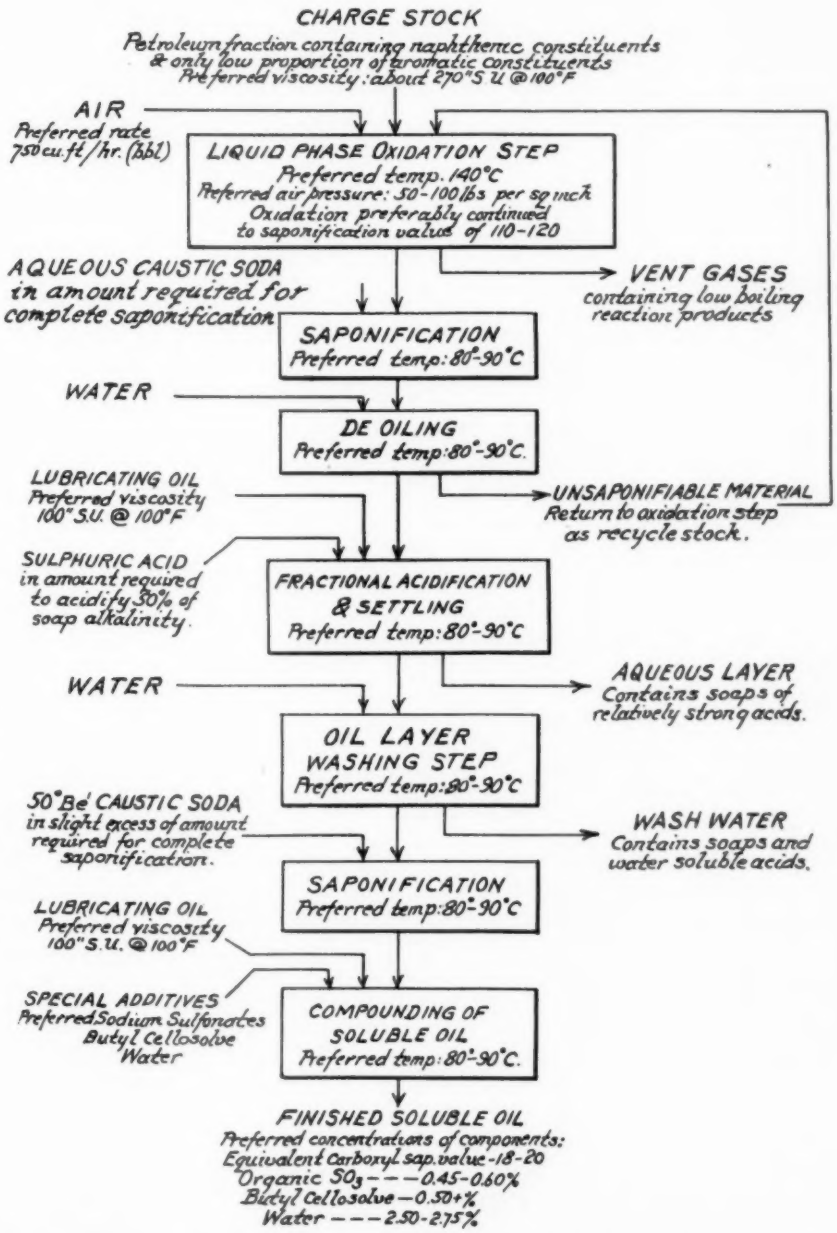

CHARGE STOCK
Petroleum fraction containing naphthenic constituents & only low proportion of aromatic constituents
Preferred viscosity: about 270" S.U. @ 100°F
AIR
Preferred rate 750 cu. ft/hr. (bbl.)
LIQUID PHASE OXIDATION STEP
Preferred temp. 140°C
Preferred air pressure: 50-100 lbs per sq inch
Oxidation preferably continued to saponification value of 110-120
VENT GASES
containing low boiling reaction products
AQUEOUS CAUSTIC SODA
in amount required for complete saponification
SAPONIFICATION
Preferred temp: 80°-90°C
WATER
DE OILING
Preferred temp: 80°-90°C.
LUBRICATING OIL
Preferred viscosity 100" S.U. @ 100°F
UNSAPONIFIABLE MATERIAL
Return to oxidation step as recycle stock.
SULPHURIC ACID
in amount required to acidify 50% of soap alkalinity.
FRACTIONAL ACIDIFICATION & SETTLING
Preferred temp: 80°-90°C
WATER
AQUEOUS LAYER
Contains soaps of relatively strong acids.
OIL LAYER WASHING STEP
Preferred temp: 80°-90°C
50°Be' CAUSTIC SODA
in slight excess of amount required for complete saponification.
WASH WATER
Contains soaps and water soluble acids.
SAPONIFICATION
Preferred temp: 80°-90°C
LUBRICATING OIL
Preferred viscosity 100" S.U. @ 100°F
SPECIAL ADDITIVES
Preferred Sodium Sulfonates
Butyl Cellosolve
Water
COMPOUNDING OF SOLUBLE OIL
Preferred temp: 80°-90°C.
FINISHED SOLUBLE OIL
Preferred concentrations of components:
Equivalent Carboxyl sap. value - 18-20
Organic SO3 - - - 0.45-0.60%
Butyl Cellosolve - 0.50+%
Water - - - 2.50-2.75%

Fig. 1—Flow sheet of Sun Oil Co.'s new method (U.S. 2.395.627) for producing soluble oils

TABLE 1—Sludge Forming Properties of Lubricating Oils Treated by Various Methods
(From U. S. Patent 2,394,965)

Hrs.	Mgms. of Sludge Per 10 Grams of Oil			
	Ferric Chloride Treated Oil	Aluminum Chloride Treated Oil	Sulfuric Acid Treated Oil	Alkaline Washed and Sulfuric Acid Treated Oil
24	4.2	4.5	8.5	2.5
48	2.4	8.5	33.4	2.6
72	1.9	19.3	10.9	8.9
96	3.2	48.0	49.5	43.0
120	2.2	104.5	79.9	94.3

fochlorinated and phosphorized lard oil and chlorinated hydrocarbon being 11-18% by weight of the lubricant.

One patent issued to Standard Oil Development Co. claims the use of a polyester produced by reacting equimolecular proportions of tri-isobutylene, succinic acid and decamethylene glycol as a **viscosity index improver.** Results obtained using SAE mineral oil were:

	No Polyester	2% Polyester
Viscosity, S. S. U.		
100° F.	275.8	378
210° F.	45.9	54.6
Viscosity Index	13	82

In the field of **soluble oils,** Sun Oil Co. has described a method (U. S. 2,395,627) for producing a material which forms stable water-in-oil emulsions. It consists of a major proportion of lubricating oil containing alkali metal soaps of relatively weak synthetic acids obtained by liquid phase oxidation of lube oil fraction containing naphthenes, together with alkali metal sulfonates. A flowsheet of the method employed in producing this oil is shown in Fig. 1.

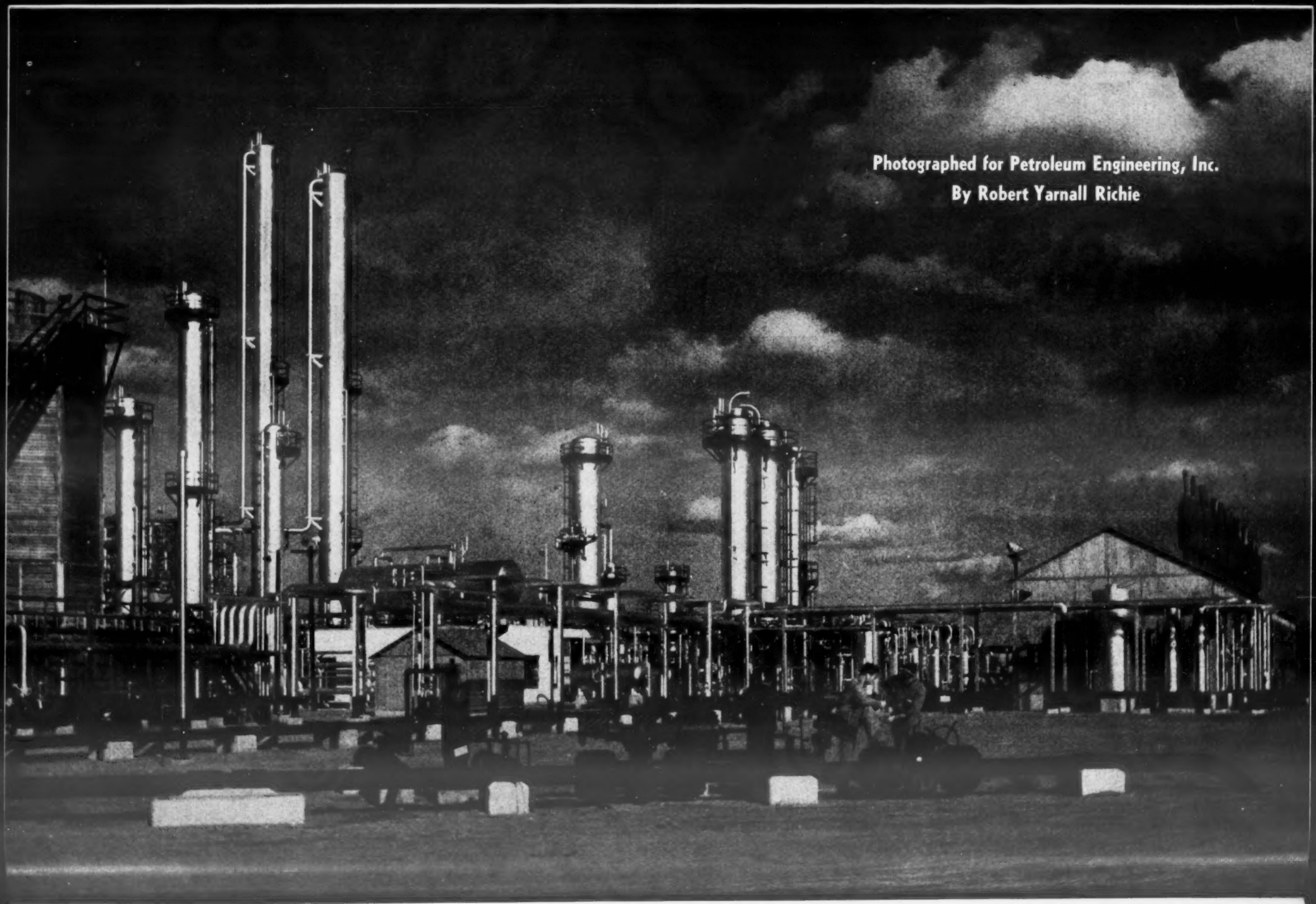
A Cities Service patent (U. S. 2,394,-965) discloses the manufacture of **lubricating oils** especially resistant to oxidation and sludge formation. The process involves first contacting the sludge-forming lube oil with 0.5-4% of hydrated inorganic ferric salt (ferric chloride) at 340-400° F., free of water except for water of crystallization, for a substantial period of time, separating the sludge so formed, neutralizing the contacted oil and finally contacting with decolorizing clay (Filtrol).

Comparison of this oil with oils treated by other methods is given in Table 1.

Selected Patents of the Month

U.S. 2,393,964 (Chicago Bridge & Iron)—Low temperature storage tank.
U.S. 2,393,965 (Briggs Clarifier Co.)—Oil dehydration.
U.S. 2,394,368 (Texas Co.)—Alkylation.
U.S. 2,394,407 (United Gas Improvement Co.)—Polymerization of heat polymerizable aromatic olefins.
U.S. 2,394,536 (Calif. Res. Corp.)—Lube oil stabilized with polysulfide and thiocarbamate.
U.S. 2,394,596 (Std. Oil Dev. Co.)—Fluoro organic compounds as anti-foaming agents.
U.S. 2,394,625 (Phillips Petr.)—Diolefins.
U.S. 2,394,631 (Phillips Petr.)—Heating catalyst chambers.
U.S. 2,394,651 (Universal Oil Products)—Contact conversion.
U.S. 2,394,654 (Pure Oil)— Cracking hydrocarbons in presence of halo epoxy compound.
U.S. 2,394,662 (Std. Oil Dev. Co.)—Removing organic acids from cracked naphtha.
U.S. 2,394,678 (Pure Oil)—Low S diisobutylene polymer.
U.S. 2,394,680 (Universal Oil Products)—Regeneration of spent catalyst.
U.S. 2,394,691 (Universal Oil Products)—Destructive hydrogenation of polycyclic hydrocarbons.
U.S. 2,394,694 (Universal Oil Products)—Isomerization of saturated hydrocarbons.
U.S. 2,394,696 (Socony)—Alkylation.
U.S. 2,394,710 (Universal Oil Products)—Contacting fluids with solids.
U.S. 2,394,716 (Universal Oil Products)—Alkylation.
U.S. 2,394,734 (Pure Oil)—S-Cl-P lubricant of high film strength.
U.S. 2,394,739 (Shell)—Hydrocarbon dehydrogenation.
U.S. 2,394,743 (Shell)—Neopentane-isobutylene polymer fuel blends.
U.S. 2,394,750 (Shell)—Catalytic conversion in presence of ferrous metals.
U.S. 2,394,751 (Shell)—Desulfurization.
U.S. 2,394,752 (Shell) — Isomerization with $AlCl_3$-NaCl-$ZnCl_2$.
U.S. 2,394,796 (Socony)—Hydrocarbon conversion.
U.S. 2,394,797 & 803 (Shell)—Isomerization to produce blending fuel.
U.S. 2,394,810 (Shell) — Isomerization-alkylation.
U.S. 2,394,814 (Std. Oil Indiana)—Handling fluent solids.
U.S. 2,394,849 (Union Oil)—Hydrocarboon conversion.
U.S. 2,394,871 (Sun Oil)—Halogenated amides.
U.S. 2,394,898 (Shell)—Isomerization.
U.S. 2,394,905 (Phillips Petr.)—Benzene alkylation.
U.S. 2,394,906 (Phillips)—Isomerization and alkylation (HF).
U.S. 2,394,928 (Std. Oil Dev. Co.)—Fluid catalyst process.
U.S. 2,394,929 (Phillips Petr.)—Alkylation.
U.S. 2,394,954 (Std. Oil Dev. Co.)—Lube oil containing alkyl xanthic acid.
U.S. 2,394,978 (Std. Oil Dev. Co.)—Cracked phenols.
U.S. 2,395,016 (Phillips Petr.)—Dehydrogenation.
U.S. 2,395,022 (Std. Oil Indiana)—Al halide hydrocarboon conversion.
U. S. 2,395,048 (Std. Oil Ohio)—Catalytic reforming of naphtha.
U.S. 2,395,050 (Dow)—Diolefin sulfone.
U.S. 2,395,057-8 (Carbide)—Butadiene.
U.S. 2,395,081 (Texas Co.)—Cracking and coking.
U.S. 2,395,093 (Socony)—Lube oil containing alcohol extract of blown lard oil.
U.S. 2,395,105 (American Cyanamid)—Crankcase lubricant containing sulfonamide.
U.S. 2,395,106 (Universal Oil Products)—Contacting fluids with finely divided solids.
U.S. 2,395,153 (Universal Oil Products)—Catalytic cracking.
U.S. 2,395,198-9 (Phillips Petr.)—Alkylation.
U.S. 2,395,240 (duPont)—Mercaptans.
U.S. 2,395,263 & 74 (Phillips Petr.)—Isomerization.

Built in Texas for a major oil company, this cycling plant is one of numerous gas processing plants designed and constructed by Petroleum Engineering, Inc. during its 16 years service to the industry. PETROLEUM ENGINEERING, INC., Offices: Houston and Tulsa.



Photographed for Petroleum Engineering, Inc.
By Robert Yarnall Richie

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NEWS

PLANT PRACTICES

. . . for refinery Superintendents and Foremen

Practical Tips and Ideas Based on Actual Refinery Operating Experience

Running a refinery is a practical operation, requiring "know-how", experience, ingenuity. Every plant has worked out special procedures and methods to meet its own problems—problems which may also exist in your refinery. This department was started by NPN's Technical Editors to serve as a clearing house for these ideas and to make them more generally available.

This month you'll find suggestions for (1) a lantern ring to increase the life of pump packing, (2) forms that aid efficient inspections, (3) a method for speeding adjustments of knock-test engines, and (4) ingenious devices for filling and crimping cans in a lube plant.

Split Lantern Rings in Pump Packing Glands Reduce Oil Losses, Increase Life of Packing

The following description of a split lantern ring designed to reduce oil losses was written from information supplied by A. B. Stevens, Conservation Engineer for a large west coast oil refinery.

PUMP drips are one of the most important sources of loss around the refinery. In a plant containing hundreds of pumps it is not difficult to visualize the magnitude of loss if packing glands are not kept snug.

To keep these glands tight requires, usually, frequent inspections and frequent repacking jobs—both time-consuming. One large west coast refinery recently developed an idea to overcome this difficulty—a split-lantern ring which helps minimize leakage and which has been installed where packing glands were not already equipped with such rings.

These lantern rings, shown in detail in Fig. 1, can be fabricated in the usual refinery shop equipped with a lathe and drill press. They are made of bronze in two parts—one flat ring and a second ring with a raised shoulder. The exact dimensions of each ring are determined to suit the shaft and stuffing box of any particular pump.

After the two parts are bored and turned to the required size, they are placed together concentrically and are drilled and tapped at eight points for No. 8-32 machine screws. Each part is then cut in half, one being cut horizontally and the other vertically (with respect to the positions in which they were placed when being drilled and tapped), so that when the rings are reassembled the two cuts will be at right angles.

The rings are reassembled on the pump shaft and are fastened together with six No. 8-32 brass machine screws, which are then cut off and peined over at each end. The other two holes are left open. It is important that the rings be reassembled in the same relationship in which they were placed when being drilled and tapped so that all of the holes are properly lined up.

As illustrated in Fig. 1, grease cups of either the spring feed type or the higher pressure screw type are installed on the packing chambers of the pumps opposite the lantern rings. In the refinery in which these rings were designed a special oil-insoluble soap was developed for use in the cups.

Lantern rings of this type have been installed on all centrifugal type pumps on which it was possible to use this system, and leakage reportedly has been greatly reduced. In addition, repacking jobs and pump shaft overhauls have also been reduced.

Data Sheets, Sketches Aid in Organizing Refinery Inspections, Minimize Delays

IN ORGANIZING an inspection so that it will proceed with a minimum of delay and still be thorough, experience had indicated the need of a central clearing point and system to keep both the mechanical and process departments fully informed as to the progress of the inspection. This is especially true of large and complicated units. Recognizing such a need, one refinery has developed a sys-

How to Make the Loss-Reducing, Time-Saving Lantern Ring

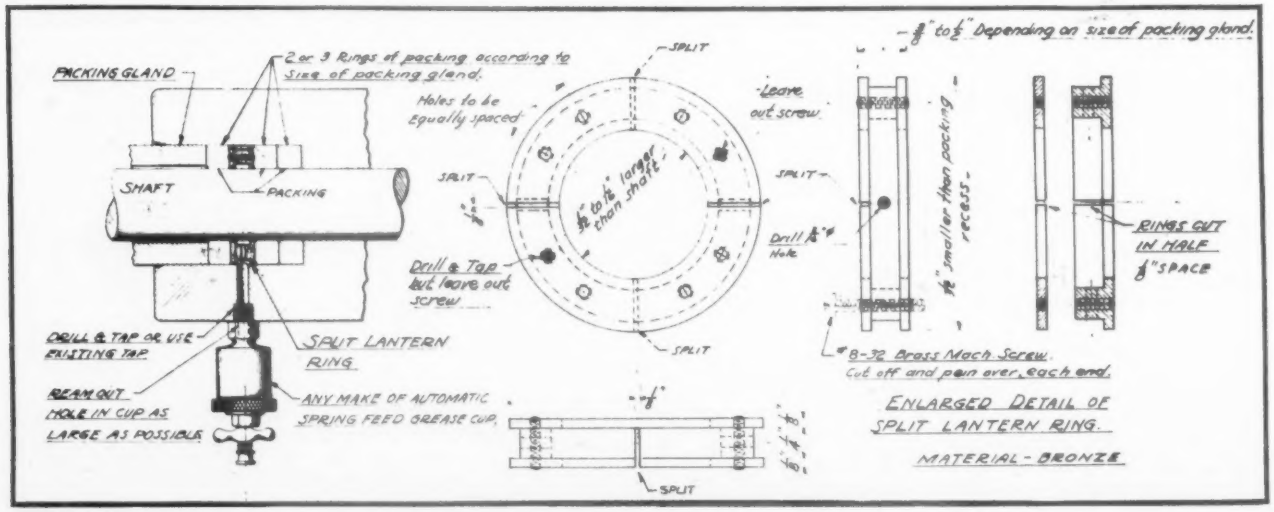
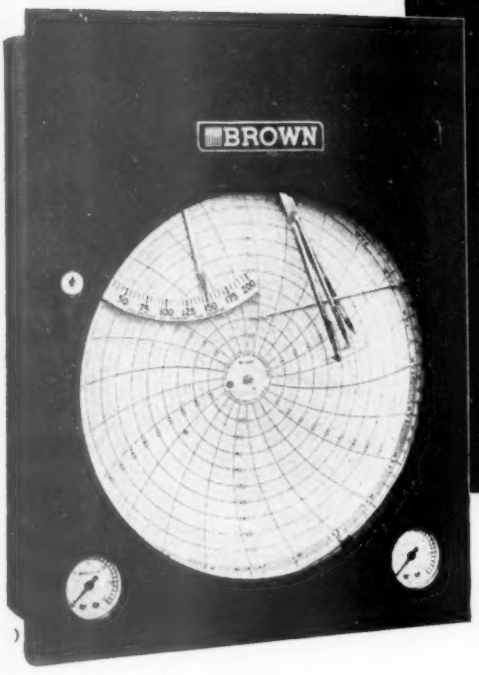
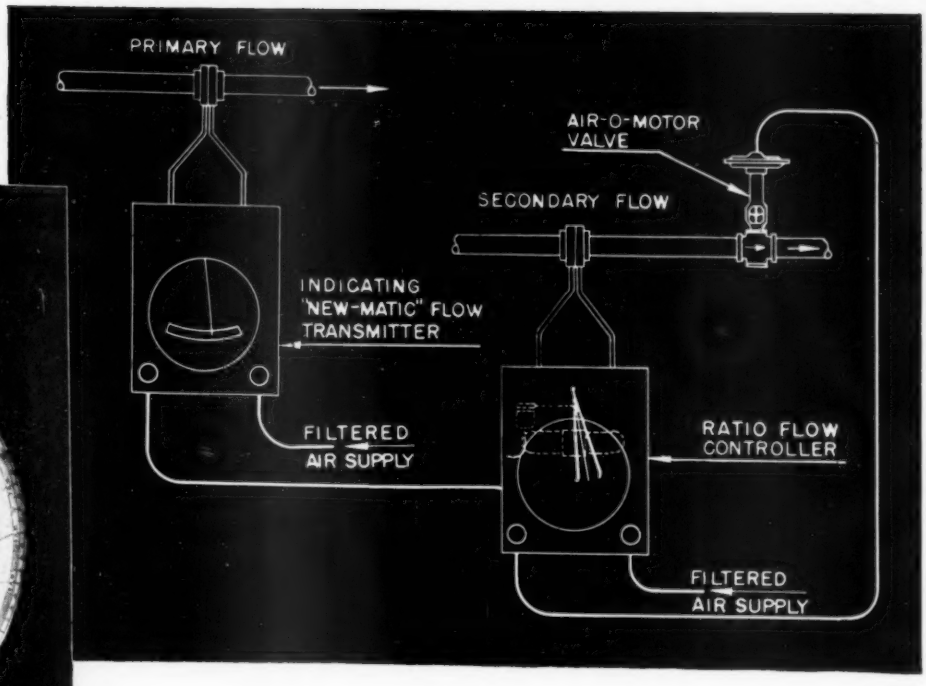

PACKING GLAND
2 or 3 Rings of packing according to size of packing gland.
SHAFT
PACKING
Holes to be equally spaced
SPLIT
Leave out screw
Drill & Tap but leave out screw
Drill & Tap OR USE EXISTING TAP
SPLIT LANTERN RING
REAM OUT HOLE IN CUP AS LARGE AS POSSIBLE
ANY MAKE OF AUTOMATIC SPRING FEED GREASE CUP
Drill Hole
RINGS CUT IN HALF
SPACE
8-32 Brass Mach. Screw. Cut off and peen over each end.
ENLARGED DETAIL OF SPLIT LANTERN RING.
MATERIAL - BRONZE

Fig. 1—Detail and assembly drawing of the split lantern ring for pump packing glands



Recording Ratio Flow Controller



FOR MIXING OPERATIONS

Maintains Ratios of Process Variables

Indicating New-Matic Flow Transmitter

Continuous processes often require the holding of a fixed ratio between two variables, usually flows or liquid levels. The Brown New-Matic Ratio Control System solves this problem.

Illustration above shows method of controlling two varying flows.

The *uncontrolled primary flow* is measured by a Brown indicating New-Matic Transmitter which develops a specific air pressure for each pointer position.

This air pressure in turn positions the Control Index of the secondary Flow Controller which in turn maintains the desired ratio between the two flows.

Provision is made for a wide range of ratios. A simple turn of the ratio setting knob is all that is necessary.

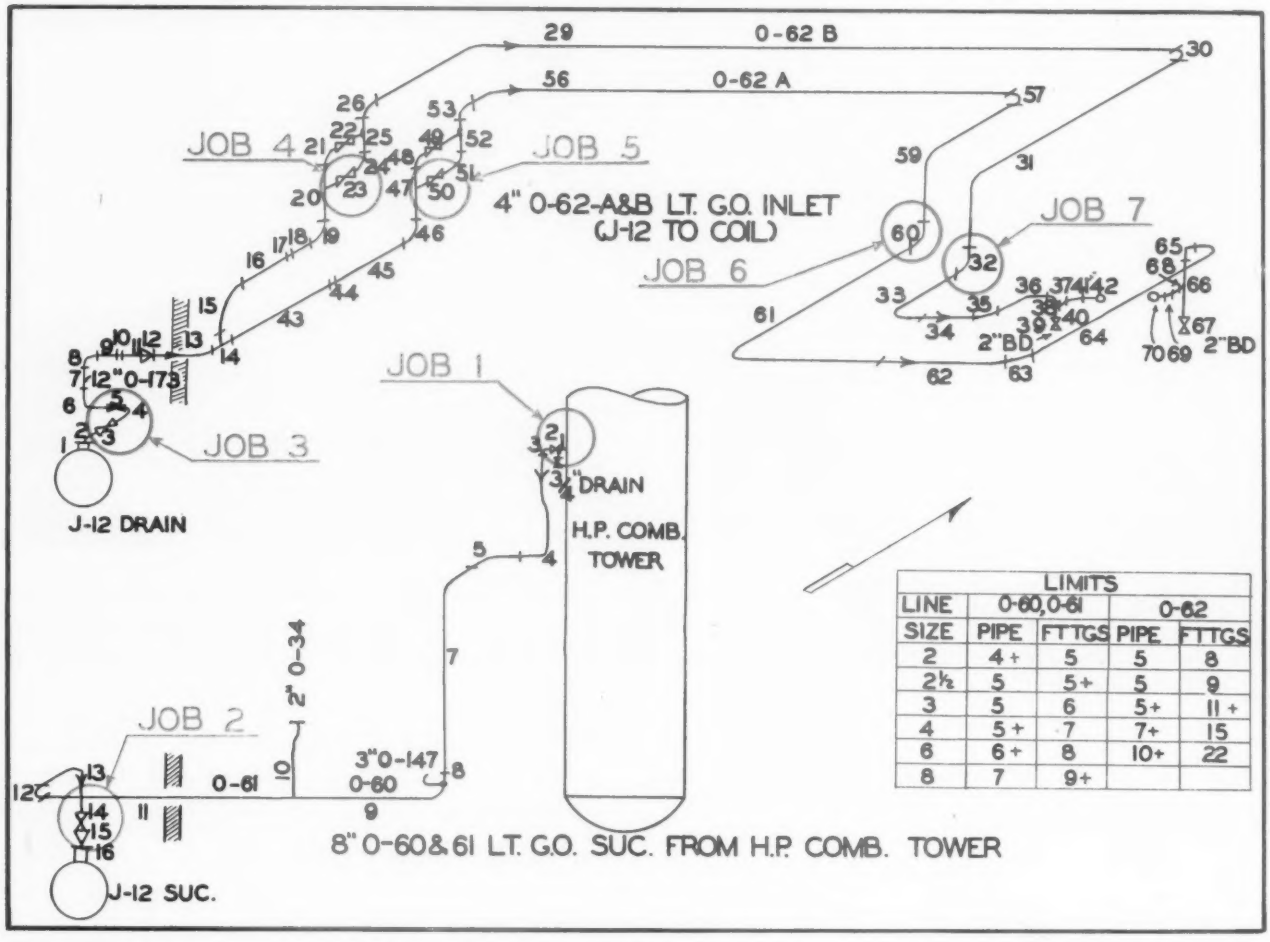
Brown Ratio Flow Controllers are available in two forms of transmission, Mechanical and Pneumatic.

The secondary flow controller makes a chart record of both flows giving the process department a complete story of the mixing operation.

Write for bulletin. THE BROWN INSTRUMENT COMPANY, a division of Minneapolis-Honeywell Regulator Co., 4508 Wayne Avenue, Philadelphia 44, Pa. Offices in all principal cities. Toronto, Canada—London, England—Stockholm, Sweden—Amsterdam, Holland.

BROWN *NEW-MATIC* TRANSMISSION SYSTEM

Sketch Shows Where to Part Piping for Inspection



LIMITS				
LINE	0-60,0-61		0-62	
SIZE	PIPE	FTTGS	PIPE	FTTGS
2	4+	5	5	8
2½	5	5+	5	9
3	5	6	5+	11+
4	5+	7	7+	15
6	6+	8	10+	22
8	7	9+		

Fig. 2—Isometric piping sketch showing the places where piping must be parted for inspection purposes, identified by job numbers

tem which has proven very successful.

Prior to the contemplated inspection, the inspector draws up a list of recommended repairs and renewals, together with piping sketches and data sheets as illustrated in Figs. 2, 3 and 4, indicating the locations that are to be inspected. This list is turned over to the process foreman in charge, who may elaborate on it because of any operational difficulty experienced during the past run. Copies of the various prints and forms are subsequently posted on a bulletin board, usually located in the unit control house, provided for that purpose. The control house is chosen since it is usually most centrally located and convenient.

TURNAROUND REPAIRS - TOWERS

RUN NO. _____ DATE: _____

TOWER	STEAM	WATER	STRIP PLATES AS NOTED	PREPARE FOR WELDERS	PREPARE FOR SANDBLASTING	CLEAN	REMOVE SAFETY VALVES FOR TEST AS NOTED	PLATED	TESTED AND OK'D	OK'D (DATE) AND BY WHOM (INITIALS)
H.P. COMBINATION TOWER										3/21/46 - DGB
CR. FL. TOWER										
KERO, G.O., & P.D. STRIPPER										
AFTER FRACTIONATOR										
FUEL OIL										

Fig. 3—Data sheet for inspection of towers. Each job to be performed to make the towers ready for inspection is marked with a red cross. As the jobs are finished, the operator indicates them with a black cross

The inspector provides a copy of the piping inspection sketches to the pipe shop foreman in addition to the set issued for bulletin board usage. The piping locations to be parted are indicated on the various prints and assigned "job numbers" as indicated in Fig. 2. Furthermore, a tabulated list for all the piping jobs is made up with the following headings: "Job Numbers," "Ready for Inspection," "Inspected" and "Remarks." Such a list is posted on the bulletin board and a copy is also furnished the pipe shop foreman. Previously made numbered tags of brass or other suitable material are then wired in place about the unit at locations corresponding to the various job numbers indicated on the piping prints.

In actual practice the system works as follows: The pipe shop foreman ar-

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*Reg. U.S. Pat. Office

Alorco Aluminas will give you a hand in...

As catalysts, carriers, and auxiliary catalysts—Alorco Aluminas, serving industry in these important tasks, may also serve you to equal advantage.

Alorco Aluminas have physical properties suiting them to long life with continued high productive capacity. They are able to withstand high temperatures. Because they are pure and carefully controlled in chemical content, there's less likelihood of uncontrolled side reactions and poisoning.

Note the types of Alorco Aluminas listed in the table to the right. You may have samples for trial in your own processes by writing ALUMINUM ORE COMPANY, Subsidiary of ALUMINUM COMPANY OF AMERICA, 2000 Gulf Building, Pittsburgh 19, Penna. Offices in principal cities.

ALUMINAS FOR CATALYTIC PURPOSES

ACTIVATED ALUMINAS (F SERIES)

These aluminas produced from crystalline aluminum tri-hydrate are catalytically active. Hard granules are available in graded mesh sizes up to one inch. Various grades are distinguished by surface area, porosity and soda contents as low as .1%.

ACTIVATED ALUMINAS (H SERIES)

These aluminas are largely amorphous. They have high surface area and sorptive capacity, high resistance to heat and live steam. Experimental lots are now available in minus-20 mesh particles or as spherical balls ¼" to ½" in diameter.

TABULAR ALUMINAS (T SERIES)

These aluminas are a form of corundum, having high strength and resistance to abrasion. They are unaffected by high temperatures. They are available in graded mesh granules and as spherical balls. Balled and granular forms have porosity of either less than 10% or approximately 30%.

OTHER ALUMINAS

Hydrated Aluminas, C-700 Series, have particles less than .5 micron. They become active after being heated to approximately 300°C. Monohydrated Aluminas, D Series, have particles approximately one micron in diameter. They are substantially inactive catalytically but have considerable porosity.

ALUMINUM ORE COMPANY

ALORCO

Aluminas and Fluorides

ranges with his men to part the piping at the indicated locations. As the work progresses, the foreman from time to time indicates that certain locations are ready for inspection by checking off the items on the tabulated list posted on the bulletin board. The inspector then compares his tabulated list with the bulletin board list and notes the additional jobs ready for inspection. Inspections are made and periodically the inspector checks back to the bulletin board to bring the list up-to-date.

Should any repairs or renewals be necessary for a particular job, they are indicated in the "Remarks" column of the list so that the pipe shop foreman will not have his men put the piping back together until the repair is completed. The foreman also knows that the necessary repair orders to cover will be forthcoming. As the inspector "Okays" the jobs, the pipe shop foreman is then in a position to direct his men to re-assemble the piping. Upon completion of the jobs, the pipe fitters remove the tags and post them on the bulletin board piping prints at the proper locations.

By using the system outlined above, the interested parties are kept fully informed as to the progress of the inspection. It also serves as a double check for the inspector.

As for towers and drums, data sheets indicating the inspections to be made are also posted on the bulletin board. Essentially, this data sheet involves the necessary prepartatory work prior to inspection and final testing. The necessary steps to accomplish this end are indicated on the sample sheet, Fig. 3. Mimeographed forms of this type are used during the actual inspection period as follows:

TURNAROUND REPAIRS - CENTRIFUGAL PUMPS

RUN NO._____ DATE:_____

PUMP	REPACK INBOARD BEARING	REPACK OUTBOARD BEARING	CHANGE LUB. OIL	DISMANTLE FOR REPAIRS	RELINE COUPLINGS	CHECK PINS IN GOVERNORS	REPACK OUTSIDE GLAND-INBOARD	REPACK OUTSIDE GLAND-OUTBOARD			REASSEMBLED AND OK'ED BY WHOM (INITIALS)
J-1	X	X	X			X					
J-1A	X	X	X	X	X	X	X	X			
J-2			X			X					
J-3	X	X	X			X	X	X			

Fig. 4—Typical data sheet used to denote work to be done and progress made in inspection and repair of centrifugal pumps

Process operations such as steaming and washing are indicated on the forms by marking in an "X" with red pencil at the proper locations. As the operations are completed, the chief operator indicates that the work is done by drawing a black cross over the "X" in pencil. The manhole cover plates are removed as designated on outline sketches of the vessels. Colored pencil is again used to indicate the cover plates to be removed. As each step in preparing the vessels for inspection is completed, the marking system mentioned previously is employed.

Similarly for exchangers, condensers and pumps, mimeograph forms have been devised to record pertinent data pertaining to their inspection and repair as indicated in Fig. 4. These forms are also posted on the central bulletin board during an inspection and the progress of the mechanical work can be followed throughout the inspection until completion using the same general methods as outlined previously.

By using the system of organization discussed, an inspection progresses without undue delays, since the various mechanical departments can plan their work better; the status of the inspection can be determined with reasonable accuracy by interested parties at any one time; and finally the inspector can obtain a double check on the necessary repairs. This system can be carried out further to include heaters and furnaces by devising forms to show the tube arrangement and a table noting such items as unplugging, cleaning, inspection, plugging and testing.

Wanted — IDEAS!

Plant operators, foremen and superintendents are invited to send in their own contributions of "how we do it around our refinery". Possible subjects could include maintenance and repairs ideas, inspection procedures, operating shortcuts — anything which has made your refinery more efficient and easier to run. Include photographs, drawings or sketches, if available.

Material accepted for publication will be paid for at our regular space rates. Contributions should be addressed to:

Plant Practices Editor
National Petroleum News
Technical Section
1213 West Third Street
Cleveland 13, Ohio.

Standardized Bouncing-Pin Contact Springs Speed Adjustments for Knock-Test Engines

EVERYONE who has operated a standard knock-test engine with bouncing-pin assembly is acquainted with the chore of adjusting tension of the brass contact springs. These springs transmit current to the knock-meter through the bouncing pin when contact is caused by the detonation wave resulting from the "knock." Frequently it is necessary to do considerable trial-and-error manipulation before the adjustment is satisfactory.

If either of the contact leaves should have tensions other than those for which the approximate setting method applies, a long, drawn-out trial-and-error period may be required either to properly adjust the pin or determine that adjustment is impossible. This job can easily involve eight man-hours per change, testers say. Not infrequently, leaves must be discarded which have good contact points and apparently still are good—simply because they will not "perform."

One large refinery, the Baytown plant of Humble Oil & Refining Co., has found that the use of springs having a known tension, or hardness, permits almost precise "approximate" spring settings before the pin assembly is installed; this reduces to a minimum the usual trial-and-error adjustment for final precision.

Tension in the contact springs of a bouncing-pin assembly is equivalent to bending the brass spring 7/64 in. for the upper leaf and 3/64 in. for the lower. In operation these springs undergo a constant flexing due to pin travel, and are also subjected to some heat. Eventually they lose their tension and must be replaced. Replacement periods, this company has found, are governed almost entirely by the initial spring tension of the leaves.

The leaves usually are manufactured by cold-rolling or pressing sheets of the special brass alloy to the desired degree of hardness and specified thickness, then stamping out the leaves. By running hardness tests on leaves as received from

the manufacturer, a desirable range of values can be set up as "standard" for whatever method of approximate tension setting is customarily used by the laboratory. Springs falling outside this range can be re-worked by stamping or pressing until the proper hardness range is attained. Deteriorated springs, which lose hardness over a narrow portion of the leaf, can be similarly restored to the same condition as new ones.

This method will not have caused them to gain or lose any properties which might preclude their meeting specifications of the American Society for Testing Materials for these springs.

Automatic Can Filler in Lube Plant Shuts Off Grease Flow at Proper Weight

AN AUTOMATIC can filler, at the lubricating oil refinery of Standard Oil Co., Cleveland, shuts off the valve through which the grease flows, at the desired weight of can and contents, replacing the former manual operation and expediting this work. The automatic arrangement was devised from parts and materials on hand in the instrument shop in the plant.

A system of mercury switches was installed in a conventional Toledo scale used in filling cans by weight. The switches operate relays which in turn operate solenoid valves, which take air off the top of the diaphragm motor valve controlling the flow of grease, to open the valve, and put air on the top of the diaphragm valve to close it. The solenoid valves are located in the air line leading to the diaphragm valve. From 50 to 100 pounds of air are required to operate the automatic filler.

In operation, when the filled can is taken off the scale it allows the scale indicator to break the contact to the solenoid valve as it passes over the mercury switch on the way up and the flow of grease is started. An air exhaust system on top of the diaphragm valve can be adjusted to allow up to 5 seconds time before the flow of grease actually starts, to give the operator time to put an empty can under the filler nozzle. When the can is filled the scale indicator on the way down breaks the contact to the solenoid valve, stopping the flow. While the automatic filler is used only for greases, plant operators believe it will work equally well on liquid products.

Cans Crimped Automatically

Another unique arrangement at the can filler rack in this refinery is a mechanical can crimper. This also is an original device, made from the pilot valve and the 2.5-in. power piston of a Hagen combustion controller and other materials on hand. In this device a solenoid valve is mounted to operate the stem in the pilot valve which determines to which end of the piston air is fed. The solenoid valve is actuated by a push button. A conventional can crimper operated through a series of levers is attached to the end of the Hagen power piston.

The piston is mounted in a sliding perpendicular shaft so that it can be adjusted for the size can to be crimped. When the filled can of grease is moved from the scale to the base of the crimper the solenoid valve actuated by push button pulls up the pilot valve stem, which puts high pressure air into the top of the power cylinder. The power cylinder forces the crimper down and crimps the can. Air introduced into the lower part of the power cylinder lifts the crimper up and the can is removed. This device also requires from 50 to 100 pounds of air to operate it. The device crimps 25-lb., 50-lb. and 125-lb. pails at a much faster rate than by using a hand operated crimper.

Both the automatic can filler and the automatic crimper were planned and installed by M. E. Faessel and Robert Joyce, instrument men at the Sohio No. 2. refinery.

Turns Grease Flow On and Off Automatically

Filling containers with grease is simplified at Standard Oil Co.'s No. 2 refinery in Cleveland with this automatic scale. When the correct amount of grease is in the can, the scale indicator makes contact with a mercury switch which, through a relay, operates a solenoid valve and puts air pressure on top of the diaphragm valve (just to the left of the scale), shutting off the flow of grease. As the full can is removed, the scale indicator makes contact with a second mercury switch at the other end of its arc, and the flow of grease starts again. An adjustable lag gives the operator time to put an empty container in place

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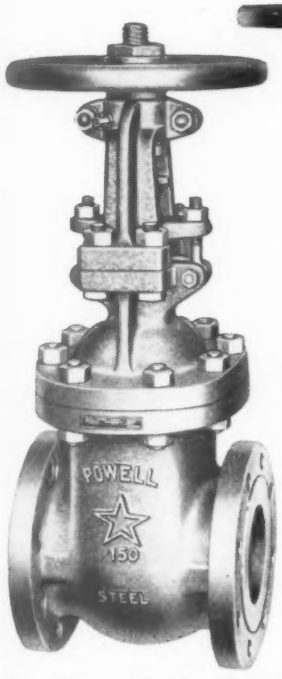
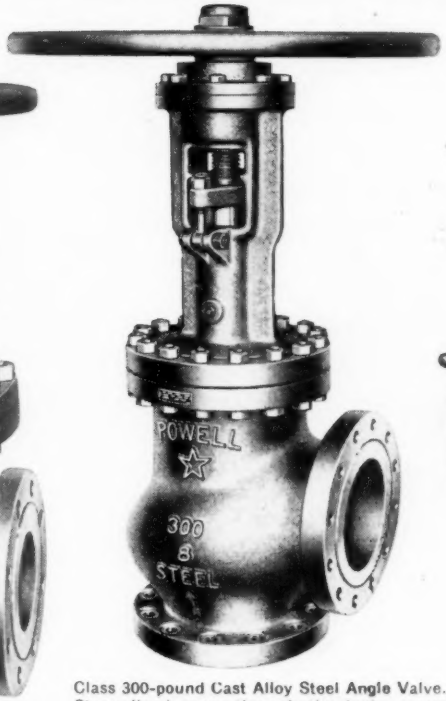
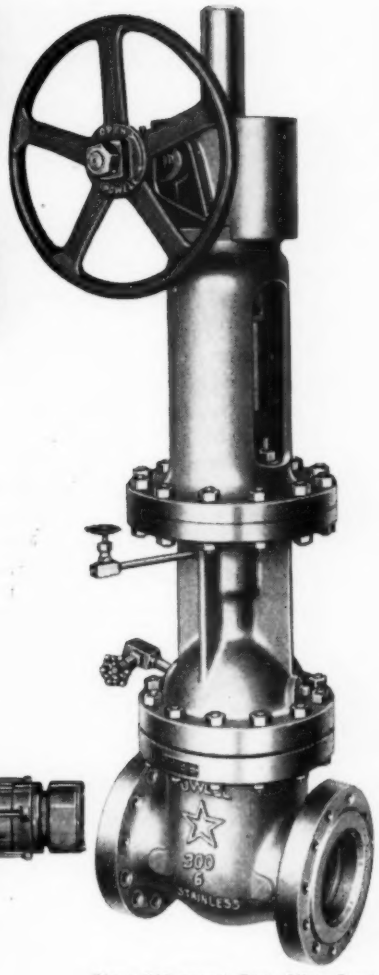


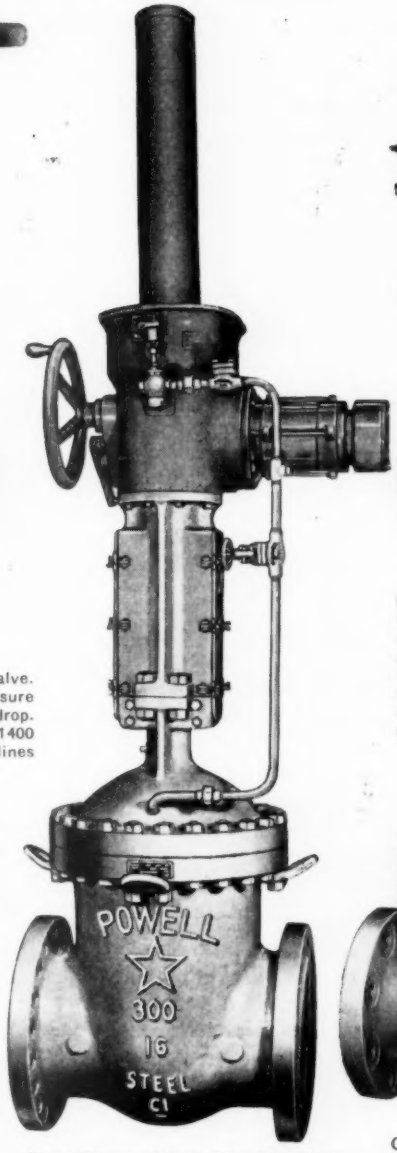
Class 150-pound Cast Steel Gate Valve. Has flanged ends, outside screw rising stem and bolted flanged yoke.



Class 300-pound Cast Alloy Steel Angle Valve. Streamlined areas through the body assure maximum flow with minimum pressure drop. Built to handle high temperatures (up to 1400 F.) such as are encountered in transfer lines in T. C. C. plants.



Class 300-pound Cast Alloy Steel Gate Valve. Designed and built to withstand the ultra-high temperatures encountered in T. C. C. Has cooling fins to dissipate the heat, thereby reducing temperature in the stuffing box. Bevel gear operated. Spur gear, if desired.



Class 300-pound Cast Alloy Steel Gate Valve, specially designed for refineries producing 100 octane aviation gasoline. Has automatic steam sealing mechanism and top-mounted fully enclosed, explosion-proof, electric motor operator for quick positive opening and closing.

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Six Articles on Fundamental Engineering for New Refining Processes

The article below is the first of a series prepared by Dr. K. M. Watson, Professor of Chemical Engineering, University of Wisconsin, and his associates on basic principles for the design, engineering and operation of reactor equipment for some of the new refining processes.

These articles are based on an extensive government-sponsored research program carried on at the University of Wisconsin to secure data which could be used in engineering the plants to produce some of the new type petroleum products required in large volume in the wartime program, such as aromatics for aviation gasoline, toluene, butane-butene for synthetic rubber, among others. The government has now released this valuable data and arrangements have been made to report it exclusively in the NPN Technical Section by Dr. Watson and his associates who directed this work.

Dr. Watson will be recalled by readers as the principal author of the series on Process Engineering published in 1944-45, which described methods for correlating and predicting fundamental data for refinery design. This series was in such popular demand that it is now in its second reprinting.

K. M. Watson

Principles of Reactor Design

Article I—Pyrolytic Dealkylation and Concentration of Aromatics

By C. O. Reiser and K. M. Watson*

University of Wisconsin, Madison

Xylene, toluene, and an aromatic hydroformed naphtha were cracked at atmospheric pressure in the presence of steam at temperatures of the order of 1450° F. In raising the concentration of the xylene fraction of the naphtha from 49% to 90% approximately 40% of the xylenes were destroyed. However, benzene and toluene were formed and the corresponding loss in total C_6, C_7, and C_8 aromatics was only 14%. A method of kinetic analysis is developed for such data in flow systems whereby the individual velocity constants and product distributions of the various reactions are evaluated.

Integration of these basic rate equations gives good agreement with the experimentally observed results in cracking the complex naphtha to concentrate and dealkylate the aromatics it contains. The method of integration for complex systems is demonstrated and its application to general problems of reactor design discussed.

IN THE fall of 1942 it appeared that the requirements for aromatic hydrocarbons in the synthetic rubber, explosives, and aviation gasoline programs might lead to a period of critical shortage before full production was realized from the new hydroforming and extractive distillation plants under construction. To guard against such a situation the Office of Production Research and Development of WPB initiated researches directed toward the development of emergency methods for the production of aromatics by utilization of existing equipment.

One possibility under consideration was the operation of a portion of the large capacity of carburetted water-gas generating equipment which is maintained in stand-by condition by the gas industry. Such equipment is readily converted to oil-gas operation by replacing the usual fuel bed with an oil burner. An oil-gas operation on selected stocks which are rich in monocyclic aromatics should produce relatively large yields of benzene, toluene, and xylenes through dealkylation of higher aromatics and concentration through the destruction of non-aromatic materials.

In order to make an appraisal of the feasibility of such pyrolytic dealkylation and concentration of aromatics, it was necessary to obtain data on the relative rates at which the various reactions involved would proceed under the conditions of a typical oil-gas operation. Since a review of the literature failed to disclose consistent data of this type a program of laboratory rate measurements was undertaken at the University of Wisconsin in cooperation with the United Gas Improvement Co. of Philadelphia. A portion of the work was carried out on a sample of heavy hydroformed naphtha containing approximately 23% xylenes and 9% toluene by volume. These tests were to establish the yields of aromatics which could be obtained when pyrolyzing this material to produce a xylene fraction containing at least 90% xylene.

Apparatus

A flow-diagram of the apparatus used is shown in Fig. 1. This equipment was designed for pyrolysis at atmospheric pressures in the presence of steam or other diluents at temperatures up to 1600° F. Compressed air was used to force liquid to the reactor from any of four calibrated glass charging cylinders. Two liquid lines ran from these cylinders to permit simultaneous feeding of water and hydrocarbon. The flow in each line was regulated by a small-taper, needle control valve. Substitution of a gas line for the water line at the inlet to the reactor permitted the feeding of gaseous diluents. The gases were taken from cylinders through a pressure regulating valve, metered and passed through a mercury bubbler which served for visual indication of flow.

The reaction products were quenched by a water cooler upon leaving the furnace and then passed through an ice-water condenser into the product receiver. Gas disengaging from the liquid was metered, a portion continuously withdrawn for a sample and the remainder burned. The density of the gas was determined by weighing in Dumas bulbs. After each run the coke formed was determined by disassembly of the reactor and mechanical removal and weighing of the deposit.

The reactor consisted of a 1-in. standard pipe of 18% Cr, 8% Ni steel mounted vertically in an electric furnace, as indicated in Fig. 2. A thermowell of ⅜ in. standard pipe of the same alloy was mounted concentrically inside the larger tube, leaving an annular reaction space ap-

*Dr. Reiser's present address is the Department of Chemical Engineering, University of Colorado, Boulder.

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proximately $\frac{3}{16}$ in. in width. Nine thermocouples were placed in the central tube with their junctions pressed against the tube wall at 1½ in. intervals as indicated in the diagram. In order to ensure vaporization of the liquid feed the upper portion of the annular reactor space was packed with wire screen to a point one inch below the top of the furnace.

The precise determination of temperature in a high temperature reactor is a very difficult problem. The arrangement shown in Fig. 2 is less satisfactory from this standpoint than would be a capillary preheater feeding a chamber with both immersed in an isothermal bath or block. In such an arrangement the feed can be heated to reaction temperature so rapidly that decomposition in the preheater is negligible and the readily determined temperature of the chamber is the true reaction temperature. However, an apparatus of this type is impractical for coke-forming stocks in the temperature range of this investigation. The reactor used is similar in general arrangement to one developed by S. R. Skeen of United Gas Improvement Co. and was adopted because of its convenience and flexibility.

A typical temperature distribution curve is shown in Fig. 6. An effort which was made to estimate the probable errors of these temperatures led to the conclusion that the error in the average temperature probably would not exceed 25° F. The thermocouples tend to read too high because of radiation from the heated walls of the furnace and tend to read too low because of conduction along the thermowell. These effects are difficult to evaluate accurately but tend to compensate. Accordingly, uncorrected temperatures were used in estimating average reaction temperatures and effective reactor volumes. Since all runs were at substantially constant conditions, any error in temperature should be approximately constant and would not interfere with the evaluation of relative reaction rates.

Analytical Procedure

The total oil product was separated from the water accompanying it and the weights of both determined. The high boiling tar formed in the reaction was removed by simple distillation to a vapor temperature of 440° F. Any water separating from the distillate was added to the main water phase and the oil charged to a 13 mm. x 72 in. Podbielniak Heligrid fractionating column. Distillate fractions were collected at the following vapor temperatures:

Benzene	150-203° F.
Toluene	203-252° F.
Xylene	252-294° F.

The volumes, specific gravities and bromine numbers of these fractions were determined and they were then treated to remove all unsaturated materials. After testing a variety of treating procedures involving sulfuric acid, mercuric nitrate, alkaline permanganate, and maleic anhydride the following method was adopted as most satisfactory on the basis of results on synthetic blends of known composition. The fraction was refluxed for one hour with maleic anhydride and then given a simple distillation. The distillate was washed with caustic and then with water. It was then given two successive treatments with 85% H_2SO_4 in an ice bath. Approximately 5% by volume of the acid was used in each treatment. The sample was then washed with water and vacuum distilled.

This rather elaborate treating procedure was required to eliminate materials which interfere with ultraviolet spectrophotometric analysis. The losses accompanying the treatment were carefully determined where possible and the yields of the treated fractions calculated on the basis of the original charge. In the case of fractions too small for satisfactory evaluation of the treating loss it was assumed to equal the olefin content calculated from the bromine number.

The aromatic contents of the treated fractions were determined by measuring their absorption of ultraviolet light in a Beckman photoelectric spectrophotometer. This procedure was suggested by Jostes[5] who found that in wave length range of 230-300 mμ aromatic compounds absorbed light without interference from paraffins, naphthenes and olefins. However, conjugated diolefins interfered and were removed by treating with 80 to 85% sulfuric acid. Jostes found it necessary to dilute the sample with hexane in order to obtain enough light for registration of the absorption maximum on photographic paper. The absorption was found to follow the Beer-Lambert Law

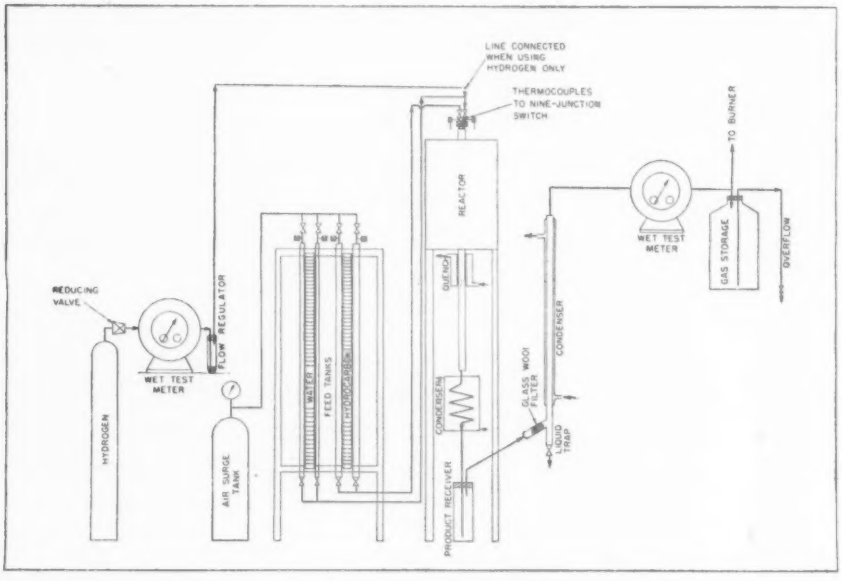
$$\log I_o / I = Esc = D \qquad (1)$$

where

I_o = intensity of the incident light,
I = intensity of the transmitted light,
E = constant called the extinction coefficient,
s = thickness of the absorbing layer,
c = concentration of the absorbing layer, and
D = optical density of the solution.

Absorption spectra for benzene, toluene and xylene and ethyl-benzene were given as plots of the logarithm of the molar extinction coefficient versus the wavelength.

In the analysis of mixtures of aromatics, Jostes determined the aromatic content from the point of maximum absorption by using an average of the extinction coefficients of the components as the extinction coefficient for the mixture. It is evident that such a method would be applicable only for an equi-



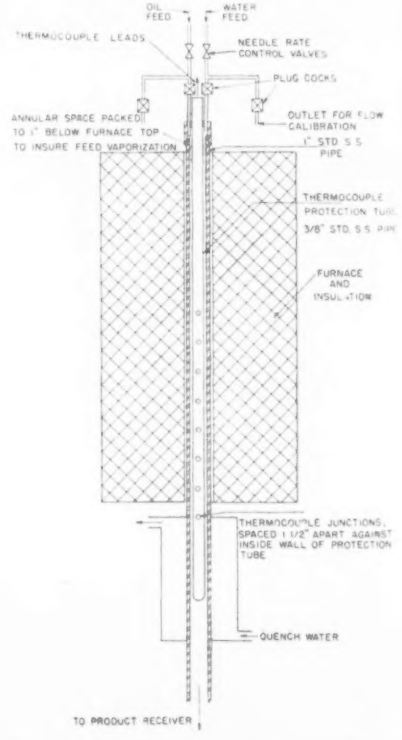

OIL FEED
WATER FEED
THERMOCOUPLE LEADS
NEEDLE RATE CONTROL VALVES
PLUG COCKS
ANNULAR SPACE PACKED TO 1" BELOW FURNACE TOP TO INSURE FEED VAPORIZATION
OUTLET FOR FLOW CALIBRATION
1" STD. S.S. PIPE
THERMOCOUPLE PROTECTION TUBE 3/8" STD. S.S. PIPE
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Fig. 1 (above)—Flow diagram of experimental apparatus

Fig. 2. (right)—Detailed diagram of the reactor in Fig. 1

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molar concentration of the conponents and that for an accurate evaluation the number of absorption measurements would have to equal the number of aromatic components in the mixture[1]. The latter method was applied by Luszczak[7], who measured the absorption at wavelengths of 2685, 2716, 2730, and 2745 Angstrom units for the analysis of a mixture of toluene and ortho, meta and para xylenes.

For the application of ultraviolet analysis to this investigation, xylene standards were obtained from the Eastman Kodak Co. and the ethyl benzene was synthesized. These standards were further purified to remove interfering substances and diluted to a concentration of about 0.2 grams per liter with an *n*-heptane solvent which had been purified by treating with alkaline permanganate and fuming sulfuric and distilling over sodium. Using these solutions, the specific extinction coefficients plotted in Fig. 3 were obtained.

The wavelengths selected were based upon the following considerations: (1) maximum absorption by one component and minimum absorption by the others, (2) maximum variation in the absorption characteristics exhibited at the different wavelengths, (3) selection of a wavelength where the absorption curves showed small slopes to minimize errors in the instrument setting, and (4) minimum absorption by interfering substances such as diolefins. Upon this basis wavelengths of 268.5 and 249 mμ or 262 and 255 mμ were selected for benzene and toluene and wavelengths of 272.5, 271, 268.5 and 262 mμ were chosen for the C_8 aromatics. The extinction coefficients at these wavelengths are summarized in Table 1.

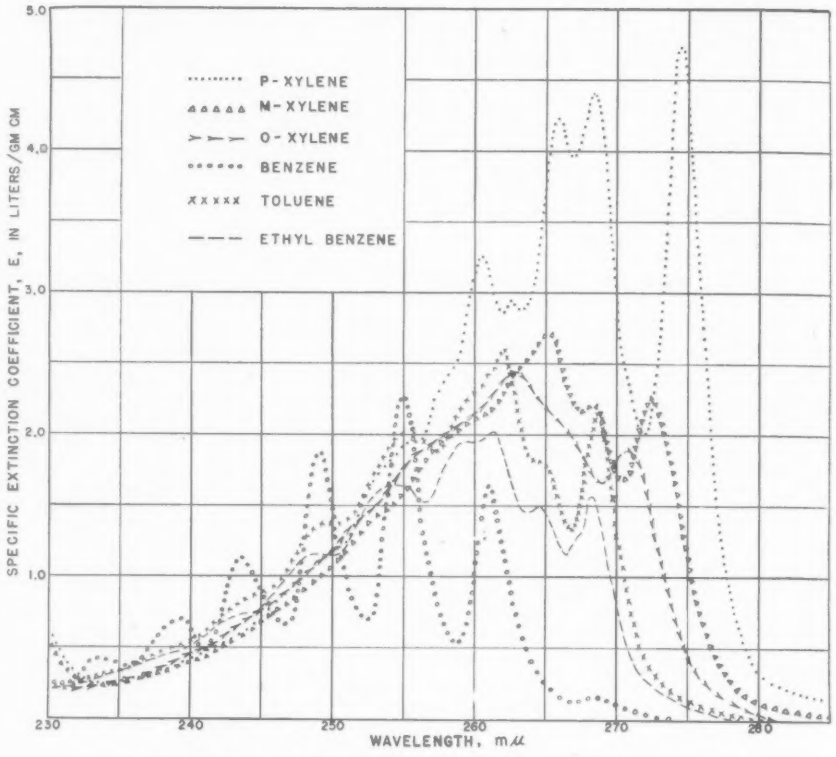

Fig. 3—Specific Extinction Coefficients of Aromatics

TABLE 1—Calibration of Ultraviolet Spectrophotometer

Wavelength mμ	Extinction Coefficient (liters)/(gm.) (cm.) o-xylene	p-xylene	m-xylene	ethyl benzene	toluene	benzene
272.5	1.41	1.98	2.41	0.18		
271	1.98	2.20	1.51	0.37		
268.5	1.60	4.90	2.30	1.57	0.13	2.52
262	2.39	2.74	2.28	1.84	1.05	2.72
255					2.37	1.97
249					2.00	1.54

TABLE 2—Equations for the Analysis of C_8 Aromatics

Concentrations g/liter	
o-xylene	$= -.3635D_1 + .8608D_2 - .3112D_3 + .1280D_4$
p-xylene	$= -.1712D_1 + .2374D_2 + .3519D_3 - .3313D_4$
m-xylene	$= +.7867D_1 - .6488D_2 - .1081D_3 + .1457D_4$
ethyl benzene	$= -.2478D_1 - .6677D_2 + .0142D_3 + .6899D_4$

D_1, D_2, D_3, D_4 are the optical densities of the solution at wavelengths of 272.5, 271, 268.5, and 262 mμ respectively.

TABLE 3—Analysis of a Texas Co. Heavy Hydroformate

Gravity °API 44.9

Engler Distillation

%	°F.	%	°F.
I.B.P.	222	60	284
10	258	70	281
20	262	80	302
30	268	90	320
40	273	95	335
50	277	F.B.P.	350

True Boiling Point Fractionation

Fraction	Vapor Temp. Range °F.	Vol. % of Feed	Aromatic Conc. vol. %
Toluene	223-236	13.0	47.7
Toluene +	236-252	10.0	2.0
Xylene —	252-273	20.5	28.6
Xylene	273-294	26.0	64.4
		69.5	

Using the method outlined by Brattain, Rasmussen and Cravath[1] for infrared analysis, four simultaneous equations were set up for the C_8 aromatics from the calibration data shown in Table 1. These equations express the optical density of the solution measured at a particular wavelength as the sum of the optical density contributions of the components. Thus

$$D_1 = E_{a1}c_a + E_{b1}c_b + E_{c1}c_c + E_{d1}c_d \quad \ldots\ldots (2)$$

where

D_1 = optical density of the solution at wavelength 1,

$c_a, c_b \ldots$ = the concentrations of the pure components a, b . . ., and

$E_{a1}, E_{b1} \ldots$ = the specific extinction coefficients of the pure components a, b, . . . at wavelength 1.

Values of the extinction coefficients, E, were found to be independent of the concentration when using narrow photometer slit widths of the order of 0.4 mm. The four simultaneous equations corresponding to four wavelengths were solved for concentration by the principles of determinants to give the equations summarized in Table 2.

In tests on aromatic mixtures of known composition this method gave errors generally less than one per cent of total mixture. However, in the presence of such interfering substances as styrene the results will be greatly in error. The treatment previously described was found to be effective in removing these materials.

Pyrolysis of Heavy Hydroformed Naphtha

In order to determine the feasibility of concentrating petroleum fractions containing considerable quantities of aromatics but not in sufficient concentration to meet specifications, heavy hydroformate fractions were thermally cracked at about 1450° F. and atmospheric pressure. The analysis of such a fraction supplied by The Texas Co. is given in Table 3. Results and conditions for the cracking of this stock in the presence of an equimolar quantity of steam are shown in Table 4 and Figs. 4 and 5. The equivalent reactor volumes shown in Table 4

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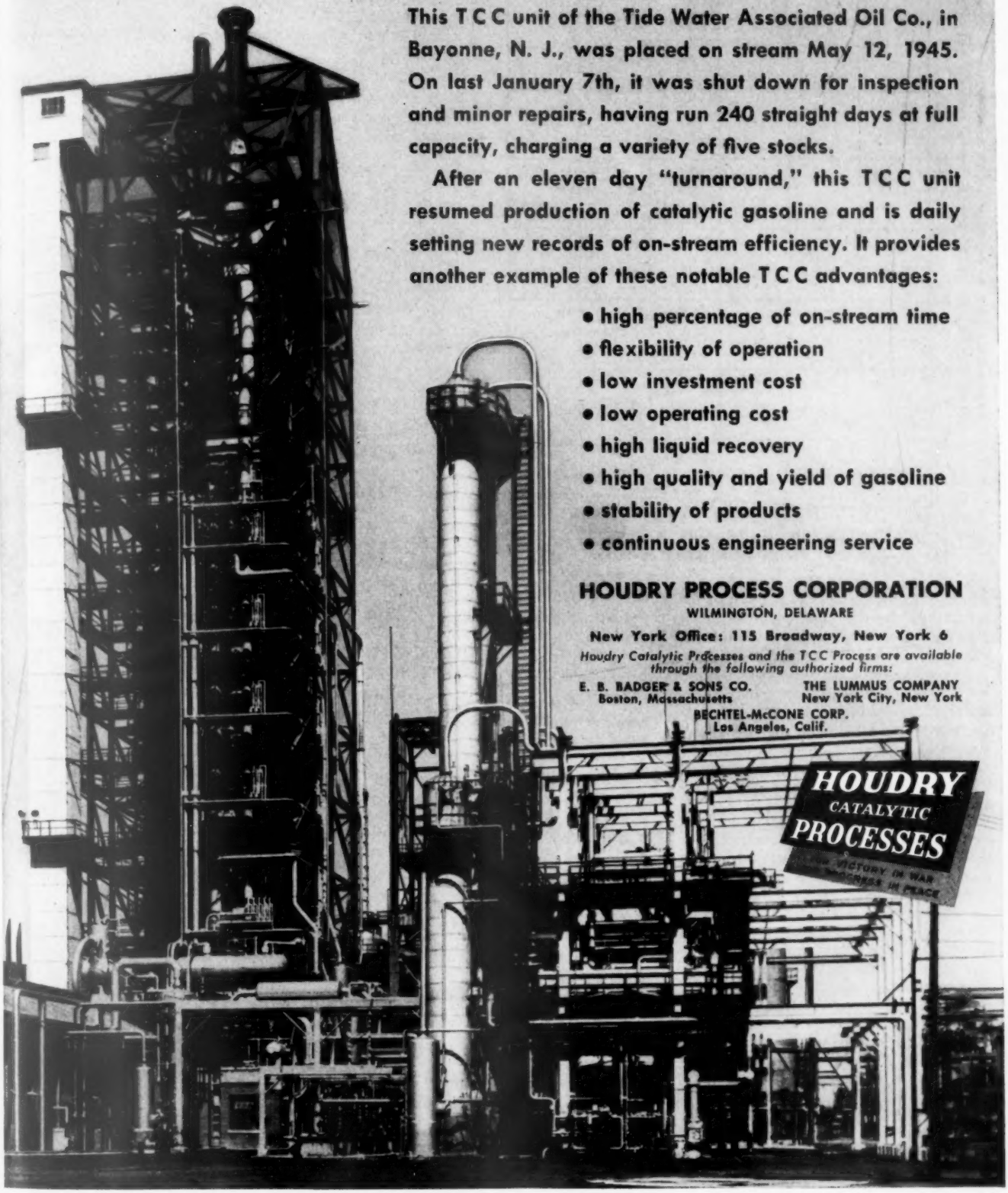

This T C C unit of the Tide Water Associated Oil Co., in Bayonne, N. J., was placed on stream May 12, 1945. On last January 7th, it was shut down for inspection and minor repairs, having run 240 straight days at full capacity, charging a variety of five stocks.

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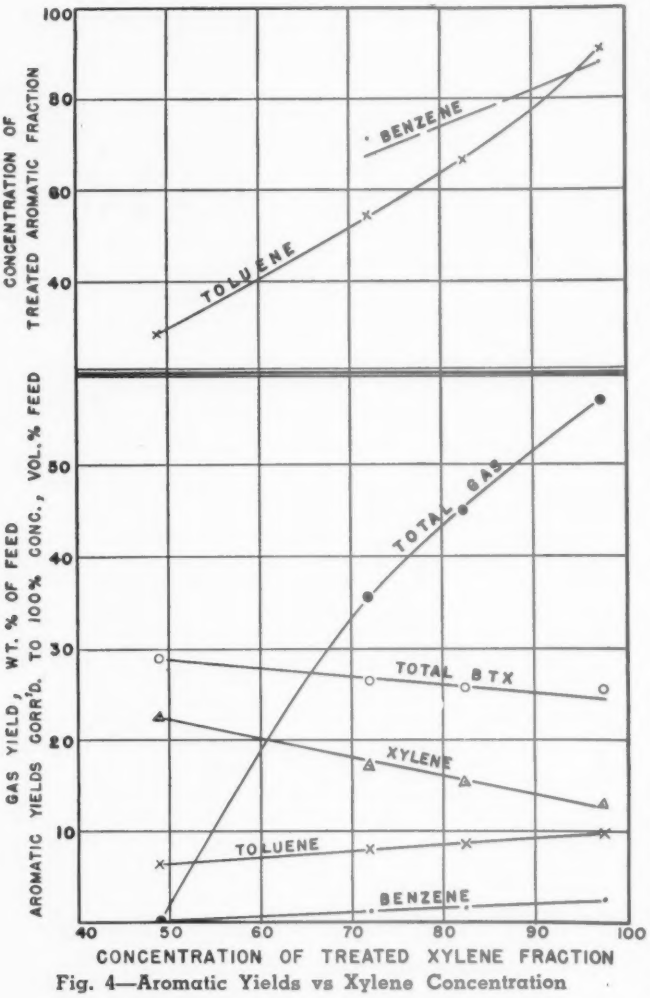


Fig. 4—Aromatic Yields vs Xylene Concentration

are the volumes which at a uniform temperature of 1450° F. would produce the same pyrolysis as the experimental reactor with its varying temperatures. The method of calculating these volumes is discussed in a following section.

Also in Table 4 are runs made on pure toluene and a commercial xylene mixture to establish the cracking rates of these materials. An additional run was made on an equimolal mixture of benzene and xylene to determine whether or not an appreciable interaction occurs to form toluene by methyl group transfer from xylene to benzene.

In Fig. 4, yields from the naphtha are correlated with the concentration of the "xylene" fraction. The term xylene is used to designate all the C_8 aromatic hydrocarbons and includes ethyl benzene as well as the three isomeric xylenes when used with reference to the acid treated fraction. When producing a concentration of 90% in the xylene fraction the aromatic yields are shown to be about 2% benzene, 9.5% toluene and 14% xylene. The total amount of benzene, toluene and xylene is reduced from 29 to 25.5 vol.-%. However, for this condition the benzene occurs in a 65-95° C. cut of only about 82% concentration and the toluene in a 95-122° C. cut of only 78% concentration. If these aromatics were to be produced in cuts of 90% concentration, it would be necessary to crack to a xylene concentration of about 97%. At this condition the yields would be about 2.5% benzene, 10% toluene and 12.5% xylene or a total BTX yield of 25%. Non-condensible gas yields of 51 and 56% by weight of feed corresponding to xylene concentrations of 90 and 97% are indicated.

In Fig. 5 molar conversions are plotted as a function of the reciprocal of the liquid hourly space velocity which is defined as the number of volumes of liquid at 60° F. fed each hour per unit of equivalent reactor volume at 1450° F. Thus, a reciprocal space velocity of zero corresponds to an infinite feed rate and zero conversion. The points shown on Fig. 5 are experimental values from Table 4, whereas the curves were calculated from the kinetic velocity constants evaluated in the following section.

Kinetic Analysis

In a flow reactor operating under steady-state conditions the progressive changes in composition of the feed may be mathematically developed by consideration of a small cross-section of reactor of incremental volume dV_r in which a conversion dx_A occurs. Then

$$r_A dV_r = F\, dx_A \qquad (3)$$

where

r_A = rate of reaction of component A, moles/(volume)(time),
V_r = reactor volume,
F = reactor feed rate, (mass)/(time),
x_A = moles of A converted per unit mass of reactor feed.

Integrating,

$$\frac{V_r}{F} = \int_o^{x_A} \frac{dx_A}{r_A} = V_f\left(\frac{1}{S_l}\right) \qquad (4)$$

where

V_f = volume per unit mass of liquid feed at 60° F.,
S_l = liquid space velocity.

In a homogeneous system at constant temperature and pressure, r_A is a function only of x_A for a given feed. Thus, Equation 4 expresses a relationship between space velocity and conversion, which for a given temperature, pressure and feed composition is independent of feed rate or reactor size and shape. It follows that rates of reaction r_A may be evaluated as the slopes of a curve relating V_r/F to x_A, which is established by a series of runs on a single reactor in which space velocity is varied by varying the feed rate. Similarly, such a curve must correspond to the integral of Equation 4. Before this integral can be evaluated r_A must be expressed as a function of x_A.

For a low pressure gas-phase reaction which approximates

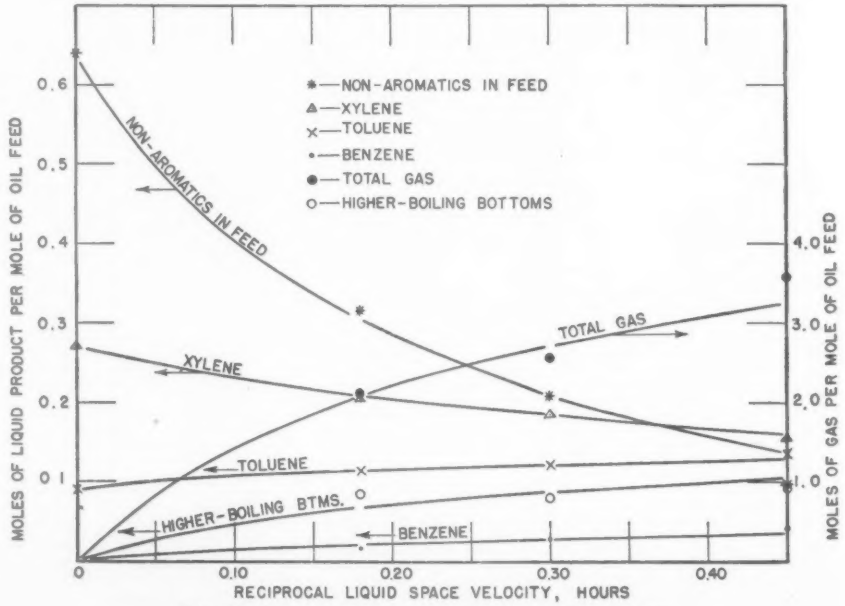


Fig. 5—Conversion space velocity relationships

TABLE 4—Pyrolysis of Aromatic Fractions

Feed Stock		Heavy Hydroformate			Xylene	Toluene	Xyl. + Benz.‡
Run No.	Feed	23	20	21	30	31	32
Operating Conditions							
Max. Temp. in Reactor, °F.		1474	1474	1480	1478	1482	1485
*Equiv. React. Vol. at 1450° F., ml.		69	64	66	67	72	73.5
Vol. of Oil per Hour, Ml.		338	190	126	184	194	171
Mole Ratio of Steam to Oil		1.02	0.95	1.32	1.12	0.90	1.01
Reciprocal Liq. Space Vel., Hours (Based on Equivalent Volume and Total Water Plus Hydrocarbon Feed)		0.20	0.34	0.52	0.36	0.37	0.43
Yields Based on Oil Feed—wt. %							
Net Gas from Oil Feed		30.7	39.1	47.9	13.6	11.8	7.3
Liquid Oil Product		68.5	56.2	46.3	86.0	88.2	86.7
Coke		0.8	2.1	4.0	...	...	...
Loss		...	2.6	1.8	0.4	...	6.0
Total Gas Formed		35.6	45.1	57.0	20.0	17.7	11.4
(Specific Gravity of Gas)		(.699)	(.729)	(.645)	(.470)	(.475)	(.457)
Yields Based on Water Feed—wt. %							
Water Vapor in Gas		5.6	9.4	7.2	5.4	4.9	3.4
Water in Liquid Product		62.7	49.4	47.4	60.8	61.5	75.9
Water Converted to Gas		31.7	41.2	45.4	33.8	33.6	20.7
Aromatic Contents of Treated Aromatic Cuts—vol. %							
Benzene	0.0	71.5	66.5	88.0			
Toluene	28.5	54.5	66.5	91.0			
†Xylene	49.0	72.0	82.5	97.5			
Ethyl Benzene	10.0	9.6	9.0	6.8	26.2		
p-xylene	5.1	8.2	10.5	13.9	22.9		
m-xylene	23.4	34.2	43.6	57.3	43.2		
o-xylene	10.5	20.0	19.4	19.5	7.7		
Yields of Aromatics Corr'd. to 100% Conc.—vol. % Feed							
Benzene		1.0	1.7	2.6	1.1	1.1	35.0
Toluene	6.4	8.1	8.6	9.8	10.8	83.5	6.7
†Xylene	22.5	17.1	15.3	12.9	64.5	1.4	43.0
Total BTX	28.9	26.3	25.6	25.3	76.4	86.0	84.7
Molal Quantities per Mole of Oil Feed							
Water in Product		.694	.558	.721	.742	.598	.802
Gas Made		2.08	2.52	3.60	1.57	1.19	0.85
Total Non-arom. in Boiling Range of Feed	.640	.350	.250	.152			
Higher-boiling Material		.049	.041	.036	.059	.009	.012
Benzene		.018	.028	.042	.015	.011	.445
Toluene	.090	.113	.119	.137	.130	.836	.071
Xylene	.270	.205	.184	.154	.649	.012	.394
Non Aromatics Lost in Treating	.013	.039	.032	.032			

* Calculated assuming an activation energy of 60,000 calories per g-mole.
† Xylene fraction contains three xylenes and ethyl benzene.
‡ Equi-molar mixture of benzene and xylene.

first order behavior,

$$r_A = k_A p_A = k_A \pi (n_A / n_t) \quad \ldots\ldots (5)$$

where

k_A = reaction velocity constant in partial pressure units, moles/(volume) (time) (atmos.),
p_A = partial pressure of component A (atmos),
π = total pressure (atmos),
n_A = moles of A per unit mass of feed,
n_t = total moles per unit mass of feed.

Also,

$$n_A = n_{Ao} - x_A \quad \ldots\ldots (6)$$

$$n_t = n_o + \delta x_A = n_o(1 + \omega x_A) \quad \ldots\ldots (7)$$

where

n_{Ao} = moles of A per unit mass in the original feed,
n_o = total moles of original feed per unit mass,
δ = increase in number of moles per mole of A reacted,
$\omega = \delta / n_o$.

Combining Equations 4, 5, 6 and 7,

$$\frac{V_r}{F} = \frac{n_o}{k_A \pi} \int_o^{x_A} \frac{1 + \omega x_A}{n_{Ao} - x_A} dx_A \quad \ldots\ldots (8)$$

Integrating,

$$\frac{V_r}{F} = \frac{n_o}{k_A \pi} \left[-\omega x_A + (1 + \omega n_{Ao}) ln \frac{n_{Ao}}{n_{Ao} - x_A} \right] \quad \ldots\ldots (9)$$

or

$$= \frac{n_o}{k_A \pi} \left[\omega \left(n_{Ao} ln \frac{n_{Ao}}{n_{Ao} - x_A} - x_A \right) + ln \frac{n_{Ao}}{n_{Ao} - x_A} \right]$$

Equation 9 permits evaluation of the reaction velocity constant k_A from a single experimental observation of x_A and V_r/F under conditions of constant temperature and pressure.

Equations 5 and 9 are rigorously applicable only to reactions of first order. It is probable that the reactions of high temperature pyrolysis proceed by a complex chain mechanism involving free radicals. However, the overall results approximately follow the laws of simple first order reactions and may be empirically treated as such.

Equivalent Reactor Volume

It is difficult to obtain rate data at constant temperature, particularly for high temperature reactions. For this reason it is generally necessary either to evaluate an effective average reaction temperature or to calculate the reactor volume which at a uniform reference temperature would produce the same conversion as the experimental reactor with its varying temperatures. Thus, considering an increment of reactor volume dV_r at temperature T,

$$(k_A)_{Tb} dV_{rb} = (k_A)_T dV_r \quad \ldots\ldots (10)$$

where

V_{rb} = equivalent reactor volume at the reference temperature T_b.

This later procedure is most convenient in analyzing data from several runs which may not be at identical average temperatures. Calculation of an equivalent reactor volume requires knowledge or an assumption as to the relationship between the

rate of reaction and temperature as expressed by the Eyring equation:

$$k_A = ae^{-(\Delta H_A^{\ddagger}/RT)} \quad \ldots\ldots (11)$$

where a and $\Delta H\ddagger$ are constants, the latter termed the "enthalpy of activation."

If an average energy of activation $\Delta H_m\ddagger$ is assumed Equations 10 and 11 may be combined

$$dV_{rb} = e^{-\Delta H_m \ddagger / R[(1/T)-(1/T_b)]} dV_r \quad \ldots\ldots (12)$$

The total equivalent reactor volume is readily calculated by a graphical integration in which the area is determined under a curve relating V_r to

$$e^{-\Delta H_m \ddagger / R[(1/T)-(1/T_b)]}$$

An alternate procedure is shown in Fig. 6 in which the reactor temperatures in Run 23 are plotted as a function of volume from the inlet. Increments of 0.5 cu. in. are considered and the arithmetic average temperature in each estimated. The corresponding values of

$$e^{-\Delta H_m \ddagger / R[(1/T)-(1/T_b)]}$$

are calculated, assuming that $\Delta H_m\ddagger = 60{,}000$, and added together. The total equivalent volume is then 0.5 times this sum or 4.23 cu. in.

It is evident that the calculated equivalent volume is affected by the value chosen for the average energy of activation. However, this effect is not serious if the reference temperature is an intermediate value and the value of $\Delta H_m\ddagger$ is reasonably close to correct. The value of 60,000 was chosen on the basis of data in the literature which indicate that the pyrolytic decompositions of many hydrocarbons correspond to approximately this value. The equivalent reactor volumes were calculated in a similar manner for the other runs.

Reaction Velocity Constants at 1450° F.

The reaction velocity constants for the cracking of toluene and xylene may be calculated by application of Equation 9 to the data of Table 4 for Runs 30 and 31. In these substitutions V_r is the equivalent volume at 1450° F., F is the feed rate in moles of hydrocarbon plus steam per unit time, $n_{Ao} = 0.5$, $n_o = 1.0$ and δ is the experimentally observed increase in total moles per mole of aromatic reacted, respectively 3.0 and 4.6 for xylene and toluene. The calculated reaction velocity constants at 1450° F., in (g-moles)/(liter) (sec.) (atm.) are 7.09×10^{-3} for xylene and 2.88×10^{-3} for toluene.

In order to compare these constants to those commonly found in the literature, they must be expressed in the concentration units used for kinetic data in static systems.
Thus, Equation 5 may be written:

$$r_A = k_{Ac}c_A = k_{Ac}(n_A/V) \quad \ldots\ldots (13)$$

Equating Equations 5 and 13 for an ideal gaseous system at constant temperature and pressure,

$$k_{Ac} = k_A(\pi V/n_t) = k_A RT \quad \ldots\ldots (14)$$

where

k_{Ac} = reaction velocity constant in concentration units, l/sec.,
k_A = reaction velocity constant in partial pressure or activity units (g-mole)/(liter) (sec.) (atm.),
V = volume of reacting system,
R = gas constant = .08206 (liter) (atmos)/(g-mole) (°K).

For problems involving flow systems constants in activity units are preferable, but the use of concentration units has been entrenched in the literature for many years. In concentration units the reaction velocity constants of xylene and toluene cracking are respectively 0.62 and 0.25 1/(sec.).

The value found for "xylene" which is a mixture of C_8 aromatic is consistent with the work of Pease and Morton[8] who found a value of 3.3 1/(sec.) for ethyl benzene at this temperature and listed the aromatics in order of decreasing stability as *o*-xylene, toluene benzene, *m*-xylene and ethyl benzene.

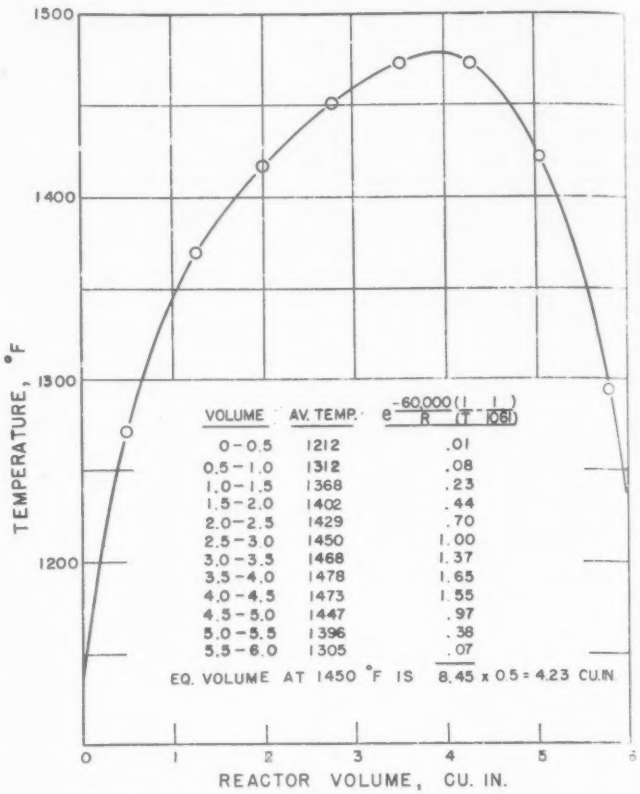


Fig. 6—Equivalent reactor volume at 1450° F.

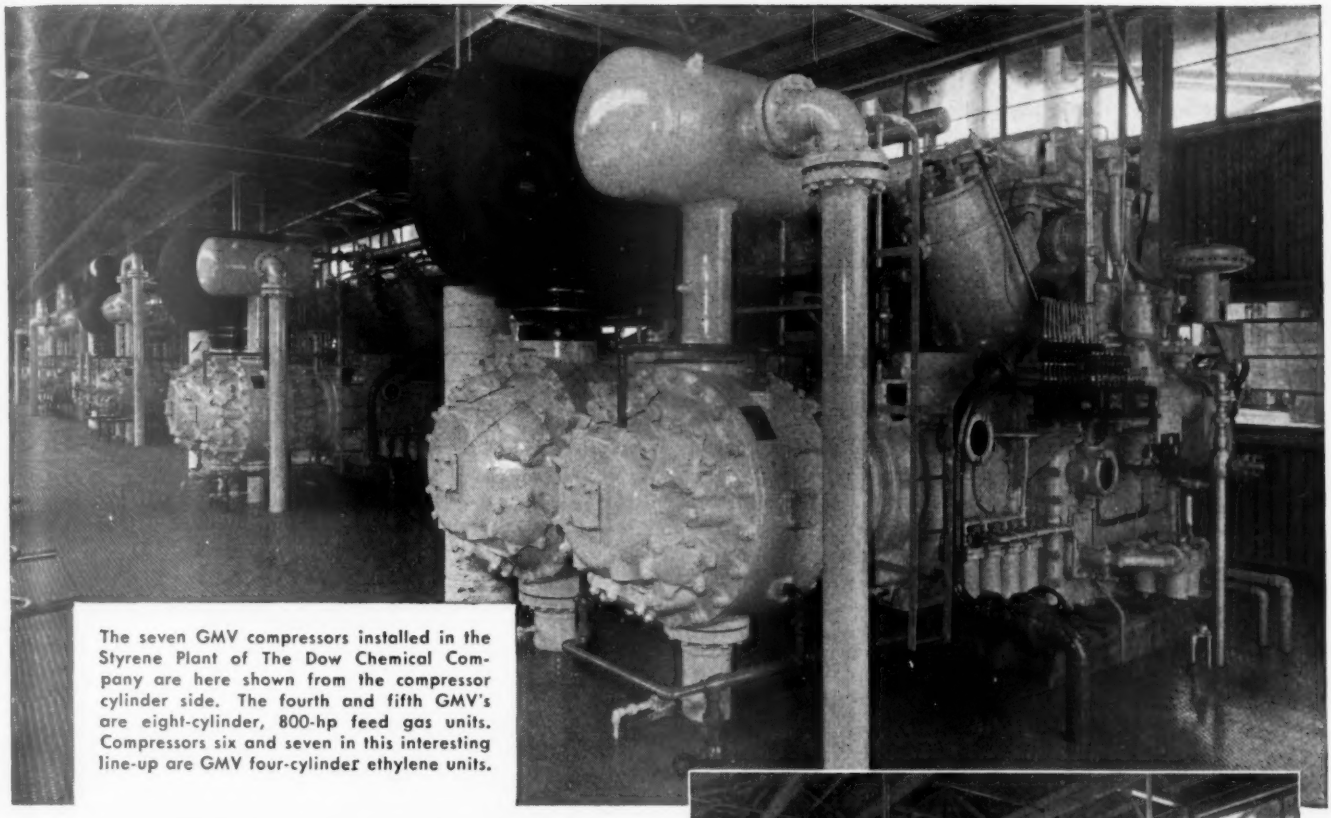
Toluene was cracked by Rosen[9], who recommended an equation leading to 22 1/(sec.) at 1450° F. This value is nearly 100 times that indicated by these measurements and appears inconsistent with the work of Pease and Morton. Since Rosen's work was at lower temperatures the error may be in his recommended enthalpy of activation of 65,000 cal/g-mole.

Run 32 was carried out with the thought that the decomposition of xylene might be accelerated by the presence of benzene through a transfer of methyl groups according to the following reaction:

$$C_8H_{10} + C_6H_6 \rightleftharpoons 2C_7H_8$$

Examination of the data show that of the xylene charged only 21% was decomposed, whereas in Run 30 on pure xylene at a slightly higher effective space velocity 35% was destroyed. If the decomposition of the xylene proceeds by a first order reaction and is independent of the presence of the benzene the percentage of xylene decomposed should be approximately the same in the mixture as in the pure compound if the mixture and the pure compound are processed at the same space velocity. This is evident if the second form of Equation 9 is applied to both cases with V_r/F and n_o equal. At low conversions the terms multiplied by ω become negligible and $n_{Ao}/(n_{Ao}-x_A)$ becomes independent of n_{Ao}. The fact that the rate of xylene decomposition in the mixture is less than would be expected from the data on the pure compound indicates that there can be little interaction between the benzene and xylene, which would lead to a higher rate of decomposition. The indicated low rate is probably experimental error in determining the relatively small concentrations obtained in processing the mixture. Accordingly, it is assumed that in mixtures the benzene and xylene decompose independently to yield the same distributions of products which were obtained in the runs on the pure components. These product distributions together with the recommended velocity constants are summarized in Table 5.

The pyrolysis of benzene has been studied by several investigators[2, 5, 9] and interpreted as both a first order and a



The seven GMV compressors installed in the Styrene Plant of The Dow Chemical Company are here shown from the compressor cylinder side. The fourth and fifth GMV's are eight-cylinder, 800-hp feed gas units. Compressors six and seven in this interesting line-up are GMV four-cylinder ethylene units.

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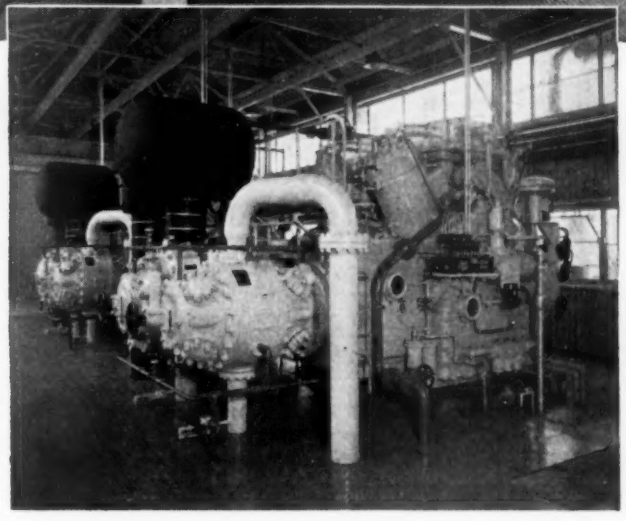

Close-up of the two GMV-4 400-hp ethylene units showing compressor cylinders, piping and control equipment.

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TABLE 5—Cracking Reaction Constants and Product Distributions Atmospheric Pressure—Equimolal Steam Dilution of Feed

	Non-Aromatics	Xylene	Toluene	Benzene
Reaction Velocity Constants at 1450° F.				
k (g-mole)/(liter) (sec.) (atm.)	19.2×10^{-3}	7.09×10^{-3}	2.88×10^{-3}	.....
k (g-mole)/(liter) (sec.) $(atm.)^2$	.....	.....	.....	2.57×10^{-2}
k_c 1/(sec.)	1.67	0.62	0.25	.....
Suggested Enthalpy of Activation	50,000	55,000	60,000	30,000
Product Distribution, Moles per Mole Decomposed				
Gas	5.04	4.46	7.24	(?)
Benzene	.055	.04	.07	.....
Toluene	.037	.37	.....	.....
Xylene	.010	.....	.07	.....
Higher Boiling Materials	.165	.17	.06	0.5(?)
Water converted per mole decomposed	.77	1.07	1.84	(?)

second order reaction. The principal product is diphenyl and based on a review of the available data Kassel[6] proposed a second order mechanism. The corresponding constants are included in the recommended values of Table 5.

The cracking reaction velocity constant of the non-aromatic constituents of the heavy hydroformate was estimated from the data of Runs 20, 21 and 23 of Table 4 by plotting x_B, the moles of non-aromatics decomposed per mole of feed, against n_t/n_B, the ratio of total moles to moles of non-aromatics. By combining and rearranging Equations similar to Equations 4 and 5

$$k_B = \frac{F}{V_r \pi} \int_o^{x_B} \frac{n_t}{n_B} dx_B \quad \ldots\ldots (15)$$

Thus, the area under the curve between zero and x_B is equal to $k_B \pi (V_r/F)$. In this manner the average value of k_B was established as 19.2×10^{-3} g-moles/(sec.) (liter) (atm.) or 1.67 1/(sec.). This is fairly consistent with a value of 3.5 1/(sec.) estimated from the correlation of Geniesse and Reuter[3] for a Panhandle naphtha.

The distribution of products from the cracking of non-aromatics was determined from the product distributions of Runs 20, 21 and 23 by subtracting out the results of the cracking of the aromatics. Thus, on the basis of one mole of hydroformed naphtha feed, at any conversion level,

(xylene left) + (xylene cracked) = (xylene in feed) + (xylene made).

If it is assumed that xylene is made only by the cracking of non-aromatics this material balance establishes the xylene yield of this reaction.

The total amount of xylene cracked at any conversion level is readily calculated from the reaction velocity constant established from the run on pure xylene. Thus, combining Equations 3 and 5, rearranging, and integrating,

$$x_A = k_A \pi \int_o^{V_r/F} \frac{n_A}{n_t} d(V_r/F) \quad \ldots\ldots (16)$$

where the subscript $_A$ refers to xylene. From the data of Runs 20, 21, and 23 a curve is plotted relating n_A/n_t as ordinates to V_r/F. The area under this curve between zero and any selected value of V_r/F is the integral of Equation 16 from which x_A the corresponding number of moles of xylene cracked per unit mass of feed is calculated. Similar equations may be written to represent the cracking of toluene and benzene. Since the latter reaction is assumed to be of second order the form differs. Thus,

$$x = k_d \pi^2 \int^{V_r/F} \left(\frac{n_d}{n_t}\right)^2 d(V_r/F) \quad \ldots\ldots (17)$$

where the subscript $_d$ refers to benzene.

In this case $(n_d/n_t)^2$ is plotted against V_r/F in order to calculate the amount of cracking.

Since toluene and benzene are each formed from the cracking of higher aromatics as well as non-aromatics, the overall material balances for these materials are of the following form:

(benzene left) + (benzene cracked) = (benzene in feed) + (benzene from toluene and xylene) + (benzene from non-aromatics)

The yields of benzene from cracking toluene and xylene are calculated on the assumption that these materials crack in the mixture with the same product distribution obtained when they are cracked alone. In this manner the number of moles of each of the aromatics produced per mole of non-aromatics cracked is calculated by a material balance difference.

The production of gas and high boiling materials and the conversion of water per mole of non-aromatics converted are similarly calculated by material balance differences, again assuming that these products from the aromatics in the mixture are the same as from pure compounds. The resulting average product distributions are summarized in Table 5. In the case of benzene there is some uncertainty as to the product distribution in the presence of steam and it is probable that some decomposition of water and gas formation will accompany the reaction. In this work benzene decomposition was of little significance and no verification of this point was made by a run on pure benzene.

Effect of Temperature

According to the Eyring[4] theory of reaction rates the effect of temperature on a homogeneous reaction of simple order in a gaseous system is represented by the following equation:

$$\kappa = a e^{-\Delta H_T^\ddagger / RT} \quad \ldots\ldots (18)$$

or

$$k_c = a' T e^{-\Delta H_T^\ddagger / RT} \quad \ldots\ldots (19)$$

where

a, a' = constants,

$\Delta H_T^\ddagger$ = enthalpy of activation.

As previously pointed out the reactions under consideration probably follow complex mechanisms through chain reactions involving free radicals and the Eyring theory is not directly applicable to the overall results. However, it is useful to express the effects of temperature by means of apparent or effective enthalpies of activation by treating Equations 18 and 19 as merely empirical. Since the data in this investigation are at only one temperature there is no basis for the evaluation of temperature effects. However, the data of the literature[2, 6, 8, 9] permit estimation of approximate enthalpies of activation which are included in Table 5. Use of these values should not lead to serious error over moderate temperature ranges.

Integration of Rate Equations

Once the effective reaction velocity constants and product distributions of the individual reactions are evaluated as functions of temperature, it is possible to calculate the results obtained in a specified reactor if it may be assumed that the reactions proceed independently. Even for complex systems such calculations are readily carried out by a progressive stepwise integration in which the reactor is considered as divided into a number of sections, each so small that in it the average partial pressure of each component may be taken as the arithmetic average of the terminal values.

The integration is started at the reactor inlet by estimating the average partial pressure of each reactant in the first small section. On the basis of these partial pressures the conversions and the incremental product formations in the first section are calculated, giving calculated values of the partial pressures at the outlet of the first section. If the corresponding average partial pressures do not agree with those originally assumed, the calculation is repeated until agreement between the assumed and calculated averages is obtained. This procedure is then repeated for the next small section and thus carried through the entire reactor. Complete conversion and product distribution curves are developed as a part of the integration.

This method of integration is demonstrated in Table 6 for the conditions of Runs 20, 21, and 23, using the kinetic constants and product distributions from Table 5. The calculated results are plotted as the solid curves of Fig. 5 for comparison with the experimental points shown for Runs 20, 21 and 23.

Reactor Design

The general method of integration demonstrated in Table 6 may be used for predicting the results of any reactor operating

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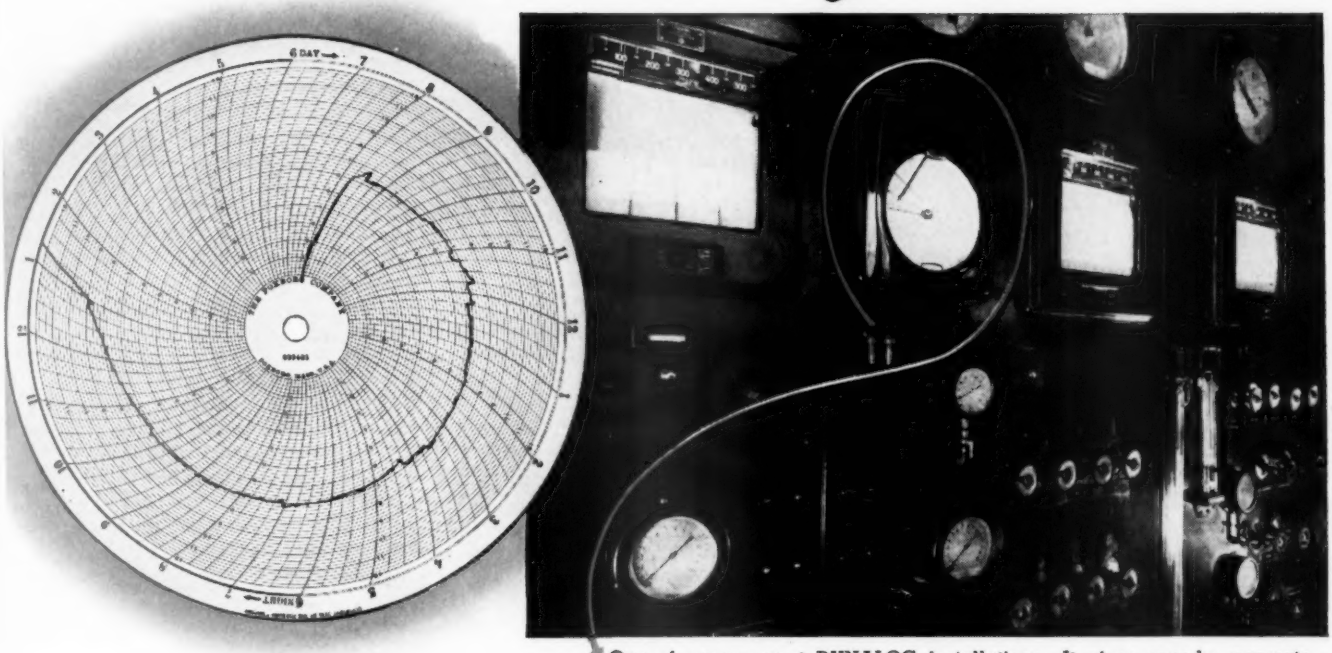

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TABLE 6—Stepwise Calculation of Reactor Conversions

Basis: 1450° F, 1 atmosphere pressure

1 Mole total feed (0.5 mole hydrocarbon feed, 0.5 mole steam feed)

$\Delta 1/S_t = D$	.02	.02	.02	.03	.03	.03	.03	.06	.06	.06	.09
$\Sigma 1/S_t$	.02	.04	.06	.09	.12	.15	.18	.24	.30	.36	.45
Total Moles, n_t											
Entering	1.00	1.134	1.243	1.337	1.456	1.555	1.640	1.714	1.839	2.005	2.089
Est. Δn_t	0.135	0.11	0.095	0.120	0.10	0.085	0.075	0.125	0.10	0.084	.10
Est. Av. n_t	1.067	1.190	1.29	1.395	1.505	1.595	1.675	1.775	1.89	2.045	2.14
Moles of Non-Aromatics, n_{NA}											
Entering	0.320	0.2874	0.2610	0.2388	0.2112	0.1884	0.1692	0.1527	0.1257	0.1047	.0880
Est. Δn_{NA}	—0.032	—.026	—.022	—.028	—.023	—.019	—.016	—.027	—.021	—.0165	—.019
Est. Av. n_{NA}	0.304	.2745	.250	.225	.200	.179	.161	.139	.115	.0965	.079
$p_{NA} = (n_A/n_T)_{Av.}$	0.286	.230	.194	.161	.133	.112	.096	.081	.061	.049	.037
Conversions											
$-\Delta n_{NA} = 5.71\ D\ p_{NA}$	0.0326	.0264	.0222	.0276	.0228	.0192	.0165	.0270	.0210	.0167	.0190
$\Delta n_t = 3.54 - \Delta n_{NA}$	.116	.093	.079	.098	.081	.068	.058	.096	.074	.059	.067
$\Delta n_G = 5.04 - \Delta n_{NA}$	.164	.133	.112	.139	.115	.097	.083	.136	.106	.084	.096
$\Delta n_B = 0.055 - \Delta n_{NA}$	.0018	.0015	.0012	.0015	.0013	.0011	.0009	.0015	.0012	.0009	.0010
$\Delta n_T = 0.037 - \Delta n_{NA}$	.0012	.0010	.0008	.0010	.0008	.0007	.0006	.0010	.0008	.0006	.0007
$\Delta n_x = 0.010 - \Delta n_{NA}$	.0003	.0003	.0002	.0003	.0002	.0002	.0002	.0003	.0002	.0002	.0002
$\Delta n_{BTMS} = 0.165 - \Delta n_{NA}$	.0054	.0044	.0037	.0046	.0038	.0032	.0027	.0045	.0035	.0027	.0031
Moles of Xylene, n_x											
Entering	.135	.1302	.1260	.1221	.1171	.1125	.1084	.1047	.0979	.0918	.0866
Est. Δn_x	— .005	—.004	—.004	—.005	—.0045	—.004	—.004	—.007	—.006	—.005	—.007
Est. Av. n_x	.1325	.128	.124	.1195	.1145	.1105	.1065	.101	.095	.089	.083
$p_x = (n_x/n_t)_{Av.}$	.125	.108	.096	.086	.077	.069	.064	.057	.050	.043	.039
Conversions											
$-\Delta n_x = 2.10\ Dp_x$	.0052	.0045	.0041	.0054	.0049	.0044	.0040	.0072	.0064	.0055	.0074
$\Delta n_t = 2.97 - \Delta n_x$	.015	.013	.012	0.16	.015	.013	.012	.022	.019	.016	.022
$\Delta n_G = 4.46 - \Delta n_x$	.023	.020	.018	.025	022	.020	.018	.034	.029	.024	.034
$\Delta n_B = 0.04 - \Delta n_x$	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0003	.0003	.0002	.0003
$\Delta n_T = 0.37 - \Delta n_x$	.0019	.0017	.0015	.0022	.0018	.0016	.0015	.0028	.0024	.0020	.0028
$\Delta n_{BTMS} = -0.17\ \Delta n_x$	.0009	.0008	.0007	.0009	0008	.0007	.0007	.0013	.0011	.0009	.0013
Moles of Toluene, n_T											
Entering	.045	.0473	.0493	.0509	.0531	.0548	.0562	.0574	.0594	.0605	.0616
Est. Δn_T	.002	.002	.002	.002	.002	.002	.0015	.002	.002	.001	.002
Est. Av. Δn_T	.046	.0485	.050	.052	.054	.0535	.057	.0565	.0605	.061	.0625
$p_T = (n_T/n_t)_{Av.}$	.043	.041	.039	.037	.036	.034	.034	.032	.032	.030	.029
Conversions											
$-\Delta n_T = 0.86\ Dp_T$	.0007	.0007	.0007	.0010	.0009	.0009	.0009	.0016	.0017	.0015	.0023
$\Delta n_t = 4.60 - \Delta n_T$	.003	.003	.003	.005	.004	.004	.004	.007	.008	.007	.011
$\Delta n_G = 7.24 - \Delta n_T$	.005	.005	.005	.007	.007	.007	.007	.012	.012	.011	.017
$\Delta n_B = 0.07 - \Delta n_T$	.0001	...	...	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0002
$\Delta n_x = 0.07 - \Delta n_T$	.0001	...	...	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0002
$\Delta n_{BTMS} = 0.06 - \Delta n_T$	...	...	...	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
Moles of Benzene, n_B											
Entering	...	.0021	.0038	.0052	.0070	.0086	.0100	.0112	.0131	.0146	.0158
Est. Δn_B	.0021	.0017	.0014	.0018	.0016	.0014	.0012	.0019	.0015	.0012	.0015
Est. Av. n_B	.0010	.0030	.0045	.0061	.0078	.0093	.0106	.0121	.0138	.0152	.0165
$p_B = (n_T/n_t)_{Av.}$	.0009	.0025	.0035	.0044	.0052	.0058	.0063	.0068	.0073	.0074	.0077
Conversions											
$-\Delta n_B = 7.64D\ p'_B$	...	...	...	...	...	...	...	...	...	...	...
Calculated Conversions											
Δn_G	.190	.158	.135	.171	.144	.124	.108	.180	.147	.119	.137
a_G	.190	.348	.483	.654	.798	.922	1.030	1.210	1.357	1.476	1.613
Δn_B	.0021	.0017	.0014	.0018	.0016	.0014	.0012	.0019	.0015	.0012	.0015
Δn_T	.0024	.0020	.0016	.0022	.0017	.0014	.0012	.0022	.0015	.0011	.0012
Δn_x	— .0048	—.0042	—.0039	—.0050	—.0046	—.0041	—.0037	—.0068	—.0061	—.0052	—.0070
Δn_{NA}	— .0326	—.0264	—.0222	—.0276	—.0228	—.0192	—.0165	—.0270	—.0210	—.0167	—.0190
Δn_{BTMS}	.0063	.0052	.0044	.0056	.0047	.0040	.0035	.0059	.0047	.0037	.0047
n_{BTMS}	.0063	.0115	.0159	.0215	.0262	.0302	.0337	.0396	.0443	.0480	.0527
Δn_t	134	.109	.094	.119	.099	.085	.074	.125	.101	.082	.100

under conditions to which the basic data are applicable. Although in the illustration conditions of constant temperature and pressure are assumed, the procedure is complicated but little by permitting these factors to vary. If the reaction is conducted in an adiabatic chamber the temperature change in each small section may be calculated from the conversion and the thermochemistry of the reactions. The same procedure is applicable to a tubular, heated reactor in which a known rate of heat input is maintained. In either case the temperature distribution in the reactor is evaluated as a part of the integration.

Similarly, if pressure changes in the reactor are significant the pressure drop in each section may be calculated as a part of the integration and a pressure distribution curve developed. Since the desired pressure at the outlet is frequently specified rather than at the inlet, it may be necessary to resort to successive integrations in which an inlet pressure is assumed and the outlet pressure corresponding to the desired conversion determined by integration. This procedure is then repeated with a corrected inlet pressure until the desired outlet conditions are obtained.

In this manner the complete operating conditions and results of a reactor required to perform a specified duty may be calculated. Arriving at an optimum design is then a problem of systematically investigating alternate design arrangements to determine that leading to the most profitable operation.

Article 2 in the new Watson series on Principles of Reactor Design will be on Pyrolysis of Propane, by P. S. Myers and K. M. Watson.

Acknowledgements

The work here reported was made possible through the sponsorship of the Office of Production Research and Development of the War Production Board and the additional financial support of the Wisconsin Alumni Research Foundation. Many helpful suggestions were received from N. K. Chaney and E. H. Smoker of the United Gas Improvement Co.

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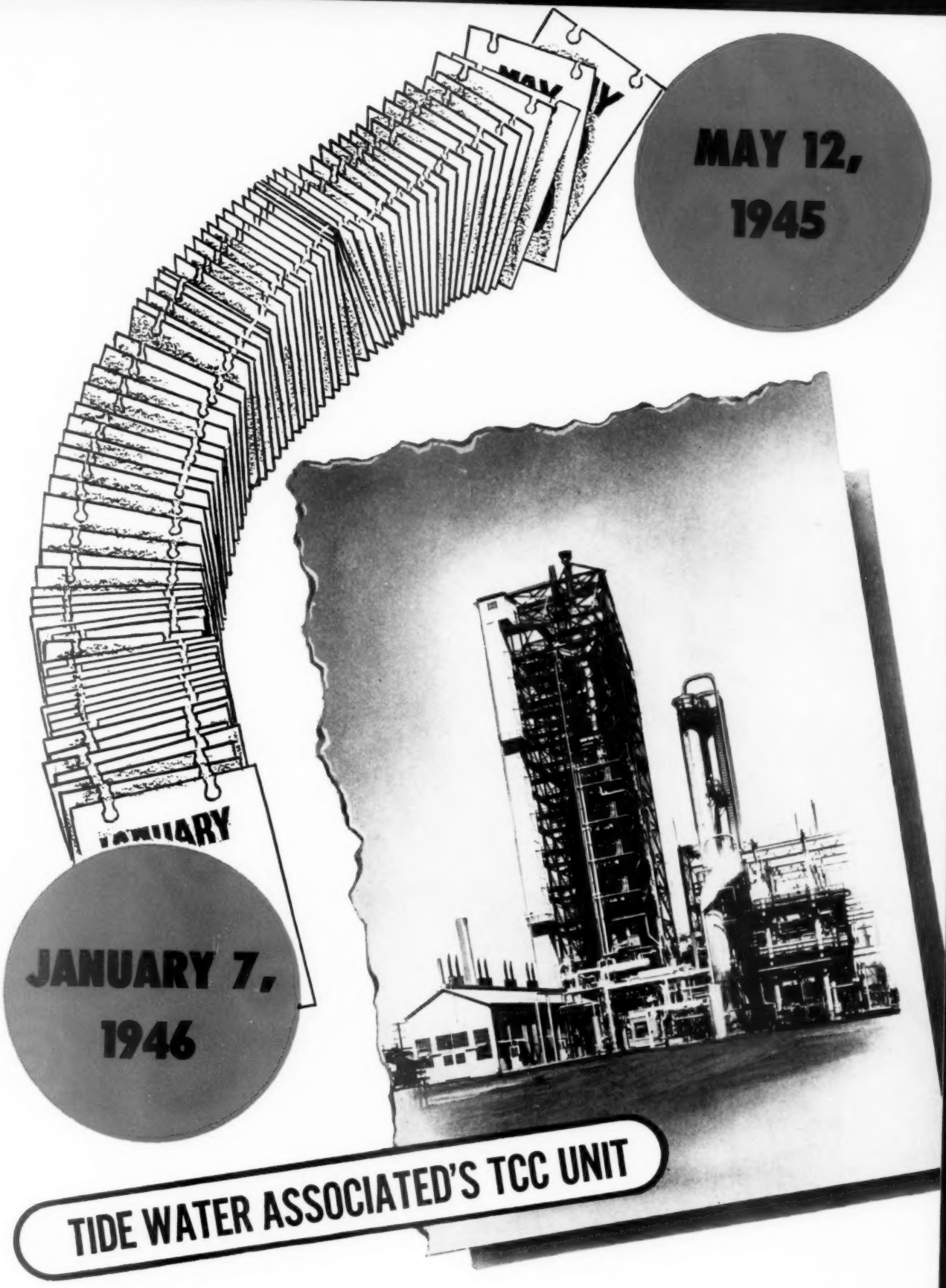

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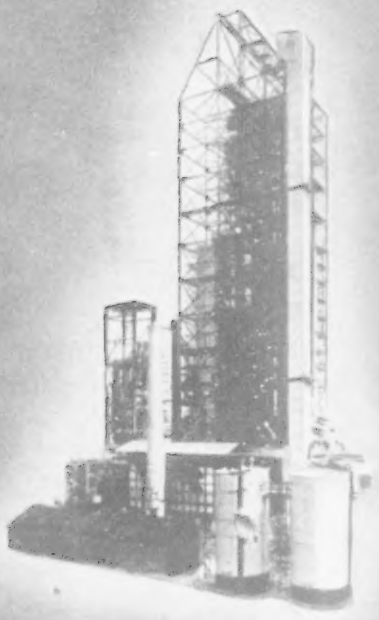

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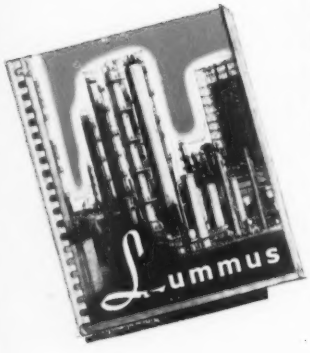

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Commercial Methods for Manufacturing Wax in Germany Are Described

***Article 3** in the Series—Some Solvent Extraction Developments in Germany*

Translated and Edited by J. Paul Jones

Member U. S. Technical Oil Mission to Germany

The German commercial method of wax manufacture during the war is described in the third instalment of the report on solvent extraction of the U.S. Technical Mission to Germany. The data was contained in a confidential report of the manager of the Edeleanu organization discovered by a combined team of British and American technologists.

Both hard and soft wax were made by solvent extraction with sulfur dioxide from tar distillate secured by the low-temperature carbonization of brown coal and, to a limited extent, from shale oil. Centrifuging was used, followed by two stage extraction, also with sulfur dioxide. Dichloroethane was used in the dewaxing step. The extract solution from the tar distillate was processed into Diesel fuel. Some fundamental studies on wax properties are also reported.

THE process of dewaxing will now be discussed. The SO_2 raffinate is freed from solvent (the sulfur dioxide) by vaporizing it. After this treatment it contains 50% or more by weight of total wax; it is therefore a very oily wax slurry, and the following process can be characterized as de-oiling just as well as de-waxing. Simultaneously with the separation of wax there is effected a separation into hard wax with a melting point of 50-52° C., or 52-54° C., or even higher, as may be desired, and into a soft wax with a melting point of 25-30° C., or even higher, and into an oil filtrate with a low pour point.

In the separation of soft wax the solvent used is dichloroethane, with or without sulfur dioxide.

The separation of hard wax is carried out at 5 or 10° C. depending upon the melting point desired, and the separation of soft wax is carried out at about —20° C. The pour point of the final filtrate will then be about —15° C or lower. The hard wax is practically oil-free. The amount of wax determined by the method of Holde is 98-99%. The soft wax contains about 10-14% of material with a higher density than corresponds to a pure waxy hydrocarbon. The exact degree of freedom from oil is somewhat inaccurate since there is no sharp dividing line between the low-melting soft wax and the fluid paraffin hydrocarbons.

The hard wax definitely meets all requirements as to freedom from oil, density, molecular weight, boiling range, distillation residue and aniline point. However, it is a somewhat different situation for the total wax and for the soft wax. As an indication of the properties of a wax, the following inspection data will be used as guide:—

- Initial boiling point, not under 100° C. at 1 mm pressure (i.e., about 300° C. at 760 mm);
- Final boiling point, not substantially greater than 300° C. at 1 mm. pressure;
- Density (D_{70}) of the distillation residue which is left at 300° C. and 1 mm., not greater than 0.800;
- Aniline point of the total wax, averaging 109-110° C.;
- Aniline point of the soft wax, not less than 102° C.;
- Complete absence of cyclic hydrocarbons for products to be used for synthesis of fatty acids.

By paying sufficient attention to the operating conditions in the dewaxing step, and by the development of a special filter, it has become possible completely to fulfill the specifications just recited. It has been found possible to remove the lower boiling constituents, i.e. boiling below 150° C. at 1 mm., and also the constituents with too high a density, which produce a distillation residue at 300° C. and 1 mm. pressure, by conducting the de-oiling at about —10° C., or by a dewaxing at this temperature, when these constituents go into the de-oiling filtrate or remain in the de-waxing solution.

It is possible, by a proper choice of the de-waxing temperature, to retain the undesired components of the total wax and of the soft wax in the filtrate. If it appears possible that the pour point of the filtrate will be too high by such a procedure and the pour point of the mixture of the two Diesel oil fractions will be above the permissible value as a result of a separation of certain Diesel oil components in the naphtha wash, the wax must be subjected to a solvent de-oiling a second time at a desired temperature. The resulting filtrate can be converted into heating oil.

The separation of waxy components by dewaxing the SO_2 raffinate, or by after-treating the total wax or soft wax fractions from the L-T.C. (low-temperature carbonization) tar from brown coal at different temperatures with dichloroethane, depends upon the materials contained in these fractions, and particularly upon the melting points of the wax components, i.e. in this case, also upon the molecular weight. In wax mixtures containing straight-chain paraffins, isoparaffins and cyclic compounds, the melting point is of primary importance in determining the separation conditions, since cyclic hydrocarbons which have the same melting point but a different molecular weight than the paraffin hydrocarbons, will be separated in the same filtrate.

As a result, as we shall learn later, by treating wax which has been obtained at a temperature of —20° C. with dichloroethane at —10° C., the low-boiling (paraffin hydrocarbons) and the highest boiling (primarily cyclic hydrocarbons) components will go into the same filt-

rate. So from a total wax fraction which has been obtained by dewaxing at —20° C., there can be obtained only soft wax components by an after-treatment at —10° C., and the low-melting components will be brought into solution including those with a melting point of 20° C. By after-treating at the —5° C., all soft wax components having a melting point up to about 25° C., will be separated, or in case the former dewaxing temperature has been changed to the temperatures of this after-treatment, these soft wax components will remain in solution.

In the extremely careful and systematic investigation of the fractional separation of wax components with dichloroethane as solvent, we have been able to obtain an indication of the composition and nature of the wax contained in tar from low-temperature carbonization of brown coal as a basis for the development of the de-waxing process. In the meantime, under stimulus of F. Schick, H. Gross and K. H. Grodde in the laboratories of the Deutsche-Erdol, A. G., a very good investigation along a similar line has been carried out and has been published in "Oel und Kohle," which has particularly dealt with waxes and mineral oils and gives an interesting glimpse of the nature of wax[a].

Our investigations which are discussed herein concern only wax present in brown coal and the shale oil. Petroleum wax from various mineral oils which have been investigated by us differ appreciably and comprise only to a small extent straight-chain and branched-chain paraffin hydrocarbons dependent upon the origin of the petroleum. For such petroleum waxes, the fractional separation with dichloroethane does not take place with the same relationships to melting point, molecular weight, density etc. as the corresponding waxes from brown coal.

In the following discussion, there will be presented a fractional separation of this nature for a total wax and a soft wax from tar produced by low-temperature carbonization of brown coal.

Table 1 presents data relating to the total wax from a tar from Hessian brown coal which was separated at a temperature of —15° C. and, as a result, no longer contained the lower melting components of the soft wax. The total wax under consideration was separated into seven fractions and a residue. The fractions which were obtained as a filtrate consist almost entirely of straight-chain paraffin hydrocarbons and, as can be seen, when they are submitted to separation at various temperature levels between —10 and 40° C., this apparently simple material produces fractions corresponding to molecular weights. The isoparaffins have increased in concentration in the residue. The total wax consists of straight-chain hydrocarbons to the extent of 87.4% and undoubtedly the 12.6% residue can still be further separated. The straight-chain hydrocarbons are in a range of molecular weight from C_{17}-C_{26}.

The determination of the molecular weight is unusually difficult for such paraffin hydrocarbons and the rules are valid only for relatively chemically pure materials and such mixtures which do not melt much above 40° C.; only for individual materials and by very careful work can reliable results be obtained for those materials with higher melting points. The best process is the freezing point method using benzene as a solvent. The boiling point method generally results in a considerable scattering of values, even for individual substances.

As a rule, we have so proceeded that we have determined the molecular weights only for the filtrates, and have calculated the molecular weights for the residues. However, even these determinations do not result in values of an accuracy greater than ±5%, and even so, are average values obtained from a large number of determinations within a narrow range. For waxes from petroleum oils, values obtained by such methods for determination of molecular weight cannot be considered very accurate when used for further understanding of the composi-

(a) "Oel und Kohle", 1942, pp. 419 ff.

TABLE 1—Fractional Separation By Dichloroethane Of A Total Wax Fraction Of A Tar From Low-Temperature Carbonization Of Brown Coal

Separation of Charge Stock and Each Fraction with 400+200 vol. % $C_2H_4Cl_2$	Charge Stock.	Melt Pt. °C	D_{70}	Aniline Pt. °C	Mol. wt.	N_{70}		Melt Pt. °C	D_{70}	Aniline Pt. °C	Mol. wt.	N_{70}	Remarks
	100 wt. %	49.0	0.776_1	108.7	345	1.432_5							
Temp., ° C.	wt. % Residue						wt. % Filtrate						
—10° C	96.0	50.5	0.775_0	109.3	(383)	....	4.0	26.5	0.793_7	91.3	264	1.440_0	C_{17}/C_{18}
0° C	86.6	51.5	0.775_0	110.5	(392)	....	9.4	34.0	0.780_9	95.3	292	1.434_0	C_{19}/C_{20}
10° C	71.5	53.5	0.774_9	113.3	(418)	....	15.1	40.5	0.778_5	98.3	312	1.433_2	C_{21}/C_{22}
20° C	49.2	56.0	0.774_7	116.8	(439)	1.433_0	22.3	46.5	0.775_9	105.0	323	1.432_0	C_{22}/C_{23}
25° C	34.3	58.0	0.775_8	119.1	(478)	1.434_2	14.9	50.5	0.774_5	110.7	347	1.433_1	C_{24}
30° C	25.2	60.0	0.776_0	120.2	(552)	1.433_9	9.1	53.5	0.774_3	113.7	360	1.433_9	C_{25}
40° C	12.6	63.3	0.777_6	121.5	(675)	1.434_6	12.6	57.0	0.774_5	117.1	380	1.434_6	C_{26}

TABLE 2—Separation Of A Soft Wax, From L-T.C. Tar From Brown Coal, By Dichloroethane

Separation of the Soft Wax, Oil Removal with 400+200 vol. % $C_2H_4Cl_2$	100 wt. % soft wax.	Melt Pt. °C	D_{70}	Aniline Pt. °C	Mol. wt.	N_{70}	Remarks	Melt Pt. °C	D_{70}	Aniline Pt. °C	Mol. wt.	N_{70}	Remarks
	wax	30.9	0.768_6	101.2	292	1.430_2							
Temp., °C.	wt. %							wt. % Filtrate					
—20° C	95.3	31.5	0.768_8	101.5	(294)	....		4.7	12	0.790_4	87.3	256	1.442_0	
—10° C	87.9	32.3	0.768_3	102.2	(294)	....		7.4	20	0.774_0	92.4	296	1.434_0	
0° C	71.6	33.8	0.768_5	103.2	(285)	....	C_{19}/C_{20}	16.3	25	0.771_2	95.8	310	1.432_0	
10° C	43.5	36.7	0.768_2	105.6	(294)	....	C_{20}	28.1	29	0.768_8	99.8	283	1.431	C_{18}
15° C	20.5	43.5	0.769_2	108.9	(310)	1.432_0	C_{22}	23.0	32	0.768_5	102.5	288	1.430_2	C_{19}

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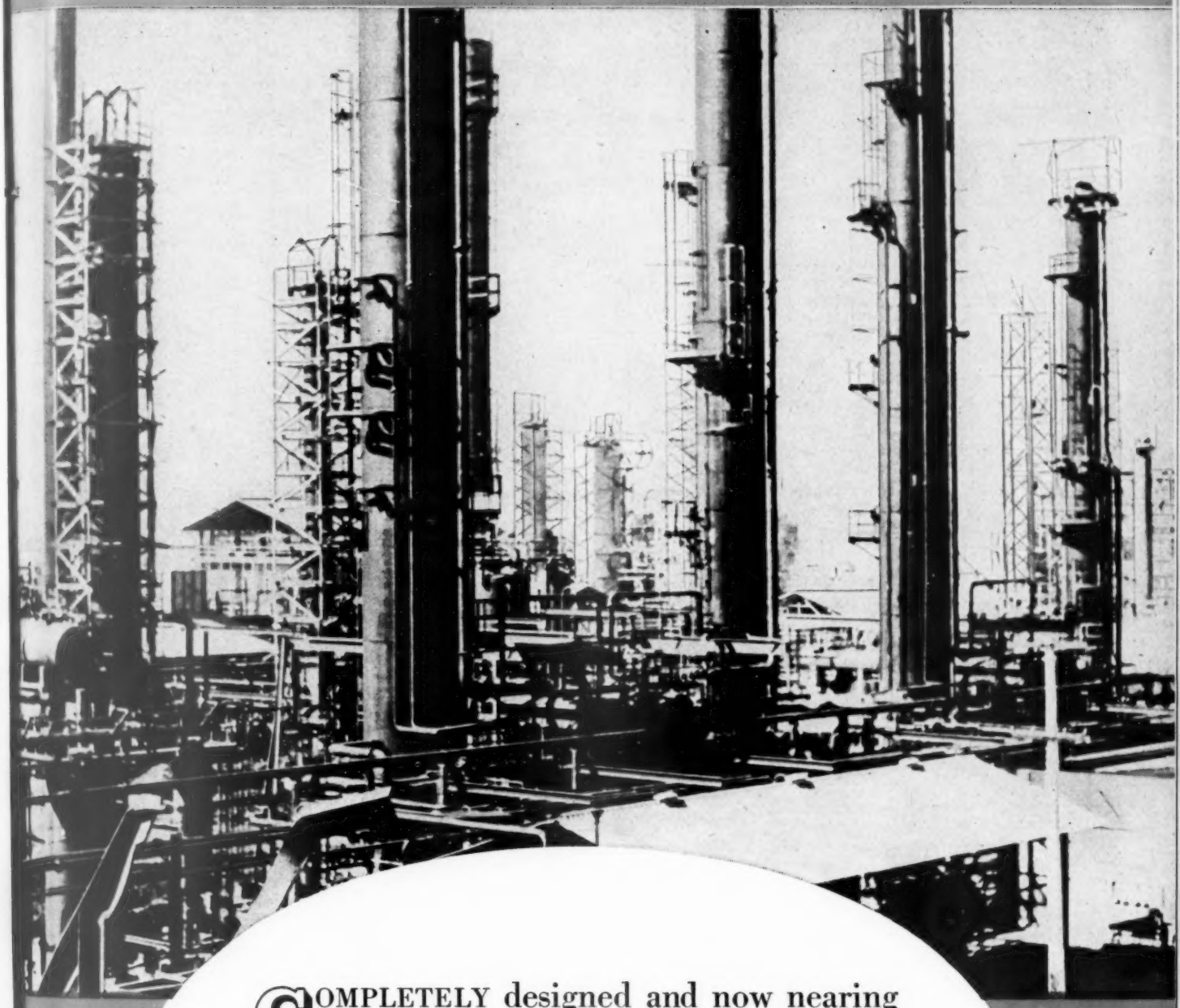

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tions of these waxes. As a result, it is not possible to say that these determinations of petroleum waxes are inaccurate and inexact within the indicated range.

Table 2 presents the data obtained from a soft wax, obtained from a tar distillate from a brown coal coming from a district in Middle Germany. It has been separated into 5 filtrate fractions and a residue by working at 5 different temperature levels between —20 and 15° C. The first fraction undoubtedly still contains oil. However, the second and third fractions also have lower melting points than correspond to the molecular weights of straight-chain paraffin hydrocarbons and are probably paraffin hydrocarbons with branched chains. On the other hand, the last two fractions and the residue come closer to containing the straight-chain paraffin hydrocarbons C_{18}, C_{19}, and C_{22}.

The relationships can be seen more clearly from the following graphical presentations.

Fig. 11 shows a melting point curve for straight-chain paraffins from C_{15} to C_{60} as a function of the molecular weight. The line which runs more or less parallel with this curve represents the various filtrate fractions from the total wax under investigation. The dotted line between the two represents the residual fractions of the soft wax, the upper part of this latter line corresponds well to the curve for the pure paraffin hydrocarbons while the last two filtrate fractions deviate further therefrom. The melting point of the residues of the filtrate fractions of the total wax deviate increasingly from the curve of the pure paraffin hydrocarbons as the extraction is carried out.

It can be readily seen that a very small amount of isoparaffinic material has a very strong influence upon the melting point since the content of such material is of the order of only 10%. The melting

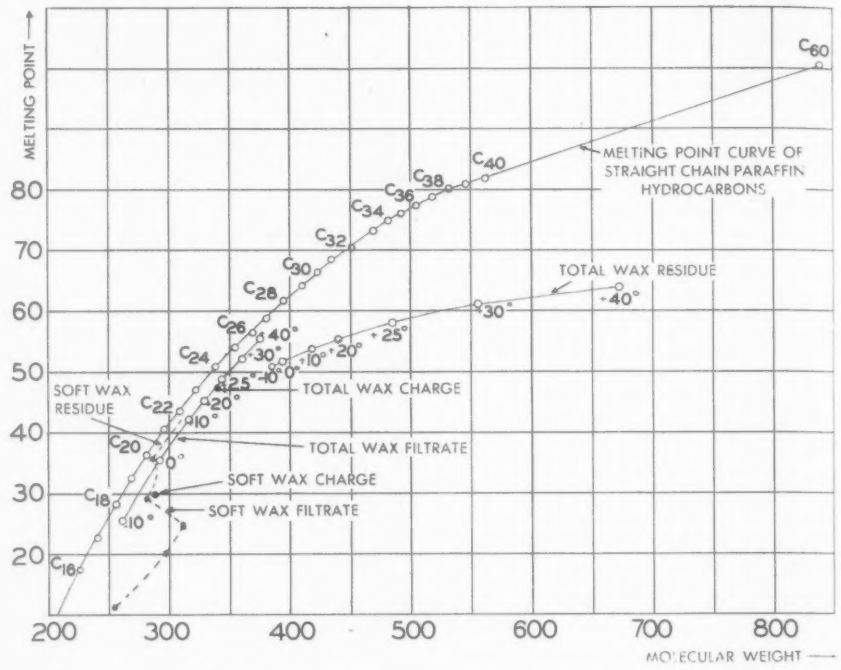

Fig. 11—Fractional separation of total wax and soft wax from an L-T.C. tar distillate from brown coal

point of the charge stocks have been indicated as circles. It can be seen that the melting point of the total wax lies on the curve of the filtrate fractions while after removal of only 4% of the filtrate, the melting point of the first residue is quite a distance from the melting point curve of the paraffin hydrocarbons.

The melting point of the initial soft wax was substantially further from the curve of the straight-chain paraffins, as a result of its high content of non-straight chain paraffin materials.

Fig. 12 shows the aniline points of various filtrate and residue fractions obtained at the various de-oiling temperatures. Both curves of the total wax tend to be directed toward a common point of intersection as the de-oiling is carried to completion, and as the aniline points increase. This point of intersection is reached at a de-oiling temperature of about 65° C. and indicates that the highest possible aniline point for the residual fraction would be about 122.8° C. The corresponding curves for the soft wax exhibit the same tendency and the point of intersection of the two curves appears to correspond to a de-oiling temperature of about 24° C. with an aniline point for the last fraction of about 112.5° C.

A second pair of curves show the relationship between molecular weight and aniline point for the total wax. In the manner in which the direction of the curve changes for the residue, it clearly can be seen that the residual fractions are becoming richer in isoparaffins while, in an exactly similar way, the curve for the filtrate shows that it tends to be composed of substantially only straight-chain paraffin hydrocarbons.

The second pair of curves in Fig. 12 also show that the aniline point is not an indication of the molecular weight since one and the same aniline point corresponds to various molecular weights. (This will be clearly shown in connection with Fig. 13). In the case of soft wax, the curve representing the change of molecular weight of the filtrate fraction as a function of the aniline point passes through a somewhat indefinite maximum point and the corresponding curve for the residue fractions passes through a similar minimum point, and it is for this reason that an evaluation of

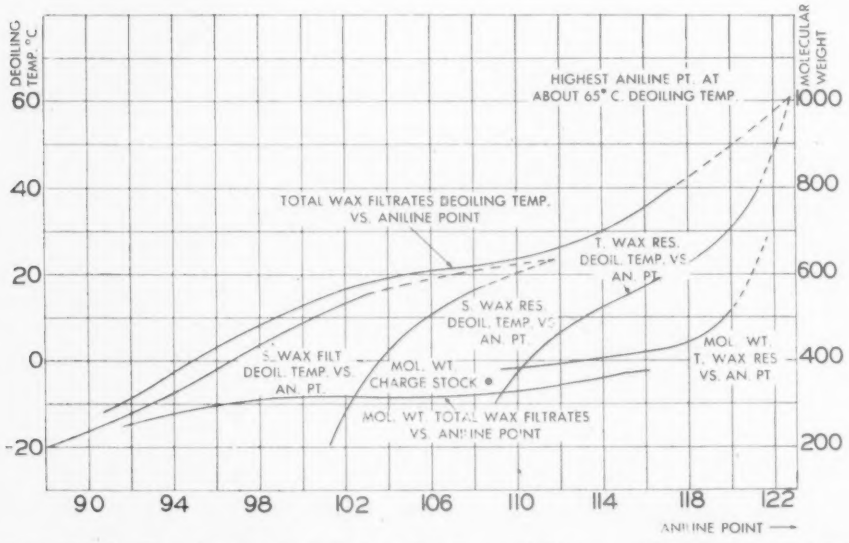
DEOILING TEMP. °C
MOLECULAR WEIGHT
ANILINE POINT
HIGHEST ANILINE PT. AT ABOUT 65° C. DEOILING TEMP.
TOTAL WAX FILTRATES DEOILING TEMP. VS. ANILINE POINT
T. WAX RES. DEOIL. TEMP. VS. AN. PT.
S. WAX RES. DEOIL. TEMP. VS. AN. PT.
S. WAX FILT. DEOIL. TEMP. VS. AN. PT.
MOL. WT. CHARGE STOCK
MOL. WT. T. WAX RES. VS. AN. PT.
MOL. WT. TOTAL WAX FILTRATES VS. ANILINE POINT

Fig. 12—Deoiling temperature and molecular weight vs. aniline point for total wax and soft wax

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C	8	46	7
D	4	17	3
E	5	10	4
F	7	12	6

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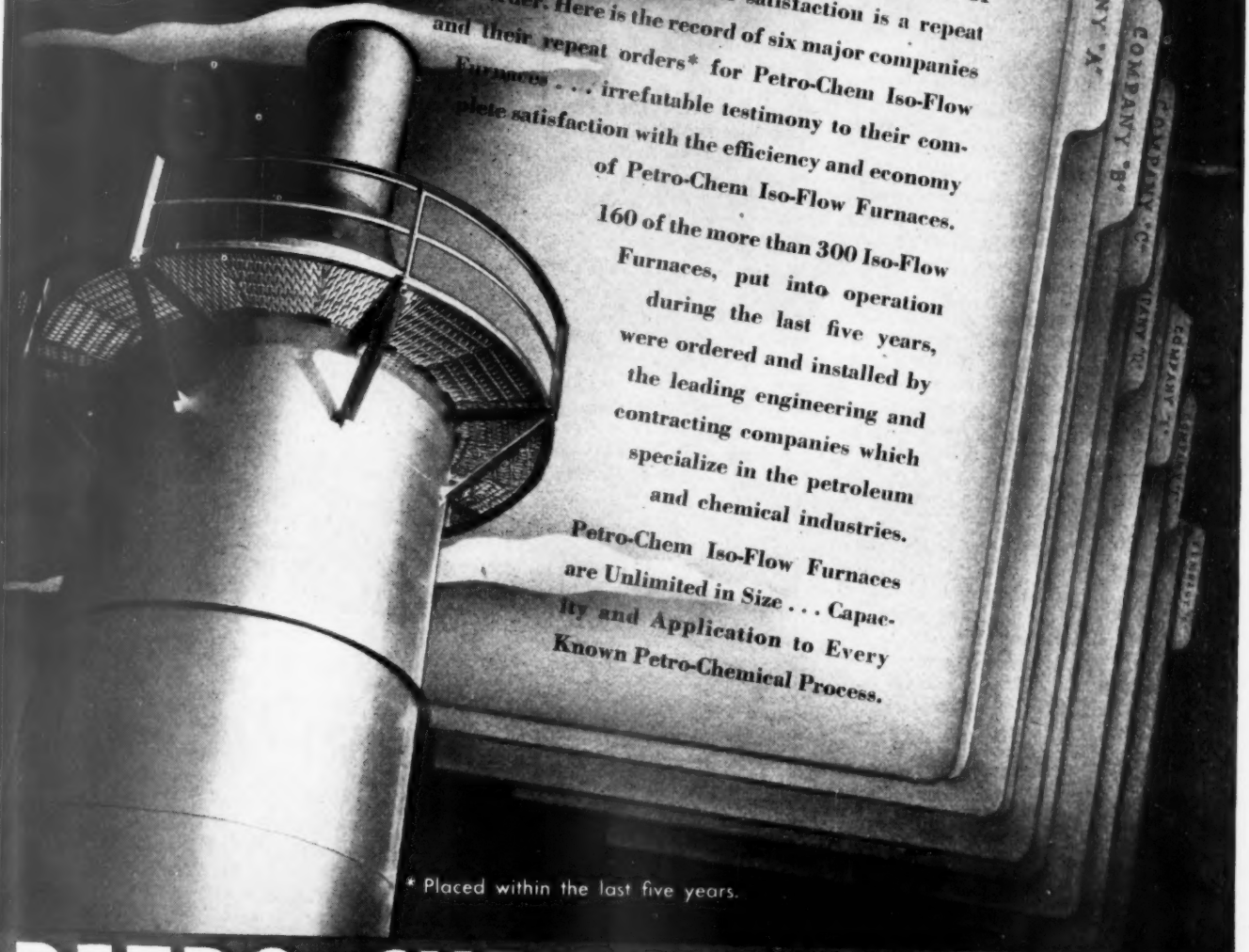

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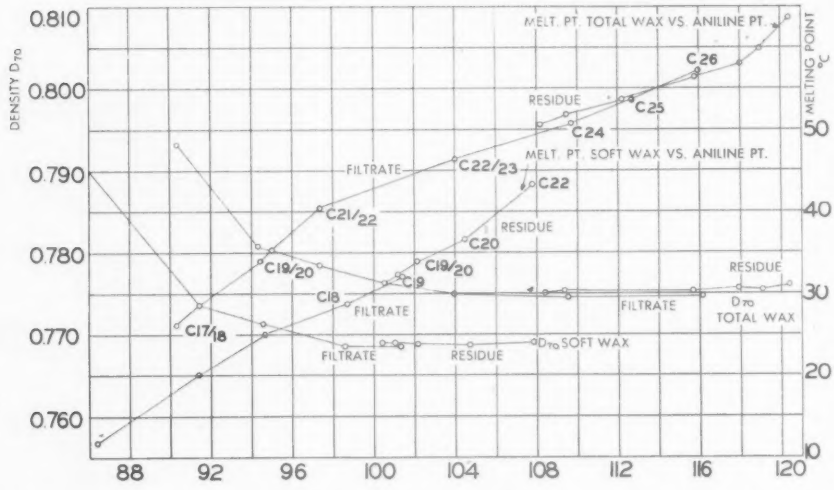

Fig. 13—Melting point and density (D_{70}) vs. aniline point for total wax and soft wax

these has been given up for the purpose of this paper.

The relationships between melting point and aniline point are presented in Fig. 13. For both types of charge stock, the curves for the filtrate fractions and those for the residue fractions tend to come together. Here also those hydrocarbons which in part tend to be more or less pure in individual fractions have the same aniline points in spite of their differences in melting points.

Of particular interest on the same graph are the curves which present the relationship between density and aniline point. It can be seen that the densities of the initial fractions for both types of initial waxes are too high for paraffin hydrocarbons and that the two first filtrate fraction, i.e. representing about 12-14% of the charge stock, must be removed by a suitable regulation of the de-oiling temperature in order that these waxes shall comply with the rules just discussed. For actual operations, this is of considerable significance, since the undesired portions which are removed at a low temperature by selective treatment with dichloroethane contain low-boiling components, i.e. all components with too high a density (oily material and cyclic compounds) remain in solution at about —10° C.

The wax obtained from shale oil is quite similar in many of these relationships to the wax obtained from brown coal even though, in general, it appears to be closely related to wax obtained from natural petroleum. Shale oil belongs to the class of natural petroleums, without any doubt. From these analyses of various waxes, it can be seen that the wax from brown coal is very good raw material for oxidation to produce fatty acids because of the high content of straight-chain paraffin hydrocarbons. The soft wax from brown coal and the wax from mineral oil should be better raw materials for the synthesis of lubricating oils as a result of their high contents of isoparaffin hydrocarbons, and also of the content of cyclic hydrocarbons in the latter material.

Separation of Tar from Low-Temperature Carbonization of Brown Coal with Yield Data for the Individual Products

We shall now pass to a presentation of technical data. The important steps are as follows:[b]

The wax-containing tar distillate is pumped into the plant with a piston pump and mixed in a circulating pump with the penultimate extract solution of the SO_2 extraction. The mixture is then cooled in a cooler to about —10° C. whereby there is a formation of two phases and wax crystallizes out. The phases are separated in a centrifuge whereby the final extract of the SO_2 extraction is separated, which is ultimately sent to the naphtha wash, while the wax-containing raffinate phase is passed to a two-stage extraction wherein it is further extracted with liquid sulphur dioxide, isothermally at 40° C. The resulting extract solution is used for the first extraction of the distillate charge stock. The raffinate solution containing wax goes to a vaporization apparatus where the sulphur dioxide is separated in three stages. This SO_2 raffinate is accumulated in a tank and is passed from there to the de-waxing step.

The extract solution from the centrifuge, which is the final extract of the SO_2 extraction, is passed at the centrifuging temperature and without separation of the SO_2 in admixture with the wax-free middle oil fraction to the naphtha wash. The mixture flows countercurrent to naphtha from top to bottom in an extraction tower at —10° C. The desired naphtha-containing raffinate solution is discharged from the top of the tower and is subjected to an after-washing in a second tower with SO_2 to remove the last traces of creosote. This raffinate from the naphtha wash, containing the components of Diesel Oil 1, is passed to a vaporization plant. It is first heated in a pre-heater in heat-exchange with condensing naphtha vapors, and then freed from SO_2 and naphtha in four stages.

The extracts from the naphtha wash obtained from the two extraction towers, and containing a small amount of naphtha and a lot of SO_2, are combined and treated to remove naphtha and SO_2 in a manner similar to that just described for the raffinate, except that five stages are

(b) Substantially as used commercially at the plant of A. G. Sachsischewerke at Espenhain. J. P. J.

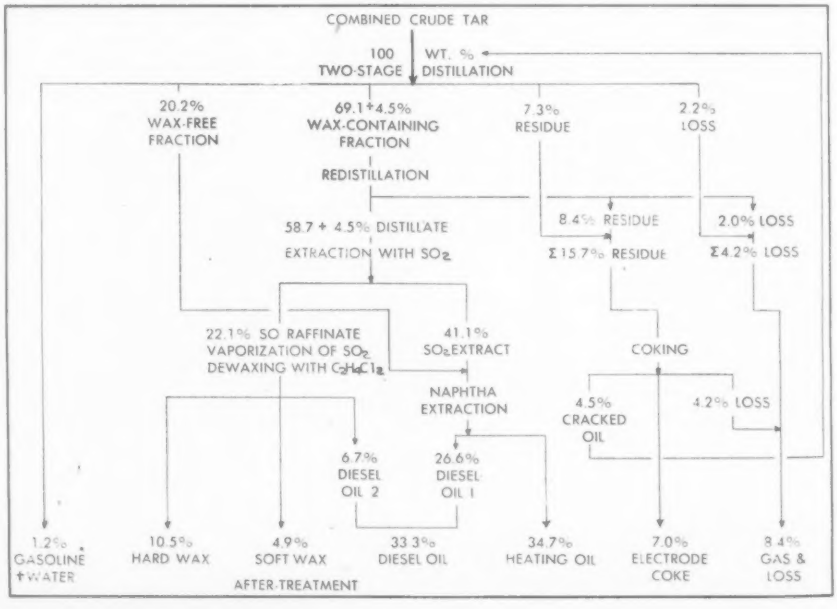

Fig 14—Separation of tar, from low-temperature carbonization of brown coal, by distillation and treatment with selective solvents

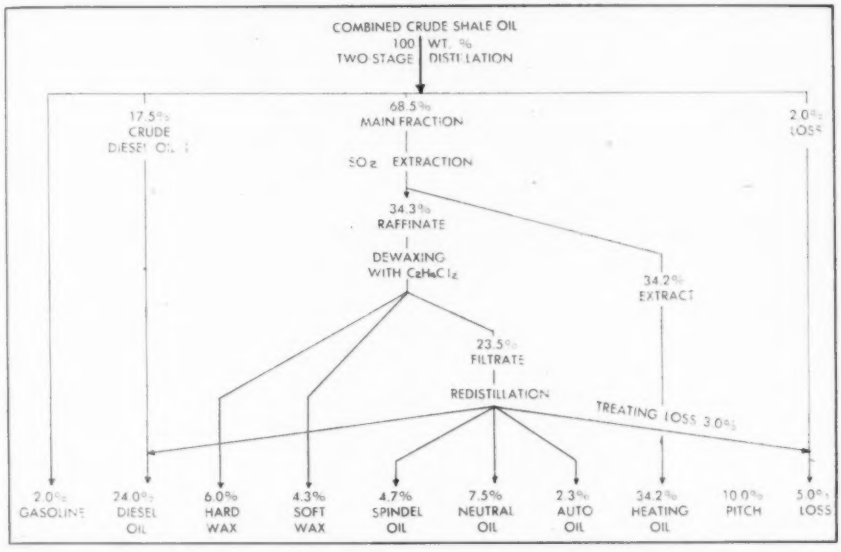

Fig. 15—Separation of shale oil by distillation and treatment with selective solvents

used. It is worthy of note that the SO_2-vapors produced in the first vaporization are used to heat the second condenser-pressure vaporizer. The extract, freed from solvent, is a finished heating oil.

Each of the vaporization plants for the raffinate has a condenser-pressure vaporizer, while on the other hand, the vaporization plant for the extract has a high-pressure vaporizer and a condenser-pressure vaporizer. The naphtha is vaporized from the naphtha-containing solution in the subsequent vaporizer and, utilizing its heat of condensation and a part of its sensible heat for heating, it is condensed in a preheater and collected in a naphtha accumulator from which it is recycled to the process. Then follows the low-pressure SO_2 vaporizer, from which the SO_2 vapors are brought to the condenser pressure by means of a compressor and also the SO_2 vapors from the vacuum vaporizer are brought to the condenser pressure by a rotary vacuum pump and a compressor. These SO_2 vapors are liquefied in the condenser and collected in an SO_2 accumulator for re-use in the process.

The wax-containing SO_2 raffinate which has been obtained from the SO_2 extraction and collected in an accumulator is passed to a de-waxing plant, diluted with dichloroethane, and cooled to the filtration temperature for hard wax in a scraper chiller. The separation of the hard wax takes place in a specially-designed continuous band filter in which the filter cake is washed free from oil with pure solvent.[c]

The hard wax so obtained is freed from dichloroethane in a three-stage vaporization plant. The filtrate solution passed from the continuous band filter contains a small amount of liquid SO_2 and is passed through a low-temperature cooler to a drum filter in which the separation of the soft wax is effected at about —20° C. As a washing liquid is used the cold solvent mixture having a similar composition; the used washing liquid goes back into service for dilution of the SO_2 raffinate. The soft wax is passed to a four-stage vaporization plant in which it is freed from the solvent. The wax-free filtrate solution flowing from the drum filter is also freed from solvents in a four-stage vaporization plant and is the final Diesel oil 2.

The vaporization of the mixture of dichloroethane and SO_2 takes place in a manner analogous to that used for the mixture of naphtha and SO_2 in the extraction part of the process.

The products which are discharged from the process are submitted to an after treatment, with the exception of the heating oil. The Diesel oil components and the soft wax are clay-treated and the hard wax is treated with sulfuric acid, and subsequently with clay in order to give it a white color.

The following tables present the results and yield data from treatment of L-T.C. tar and of shale oil.

In Fig. 14 is presented the process for separating various products from an L-T.C. tar from a brown coal obtained from central Germany.[d] The raw tar consisting of tar from the pre-cooler, tar from the electric precipitator and middle oil is subjected to a two-stage distillation, at atmospheric pressure and under vacuum, and separated into a small amount of naphtha and water, a wax-free middle oil fraction, a wax-containing fraction, and a distillate residue. The wax-containing fraction is subjected to a redistillation in order to produce a white hard wax. The two distillation residues—from the first distillation and from the redistillation—are coked to produce electrode coke, and the resulting cracked oil, which contains colored material, is mixed with the raw tar prior to the initial distillation.

The wax-free and the wax-containing fractions are separated by means of selective solvents into Diesel oil, heating oil, hard wax and soft wax, as already discussed.

By this procedure, the following products are obtained from 100 kgs of combined crude tar:

	kg.
Naphtha and water	1.2
Hard wax	10.5
Soft wax	4.9
Diesel Oil	33.3
Heating Oil	34.7
Electrode Coke	7.0
Gas and Loss	8.4

Treatment of Shale Oil

A similar treatment of shale oil is shown in Fig. 15. In this instance, a shale oil has been obtained from the Puertollano oil shale in Spain, which has been quite thoroughly investigated; however, the treatment discussed herein is basically the same for L-T.C. tar from oil shale from other sources.

The combined crude shale oil is also subjected to a two-stage distillation; the resulting distillate can be treated more easily than the L-T.C. tar distillate produced from brown coal. The method of treatment has already been discussed.

The Diesel oil obtained by distillation is a very good Diesel oil, judging by its pour point and its other properties. Only the principal fraction of 68.5% by weight is treated with liquid sulfur dioxide

(c) See National Petroleum News Technical Section, Dec. 5, 1945, pg. R-950.

(d) Substantially as used commercially at the plant of A. G. Sachsischewerke at Espenhain.

TABLE 3—Results Obtained from Treatment of L-T.C. Tar from Brown Coals Produced in Various Districts in Germany

Crude Tar Separated Into	—Tars From Central Germany— 1	2	3	4	Hessian District	Sudeten District	Tar From Pressure Gasification
Gasoline	2.0	2.5	1.5	1.8	2.7	1.5	(topped)
Hard Wax	11.5	7.7	12.3	14.0	7.6	3.5	5.9
Soft Wax		6.0	6.4	6.8	3.6	2.0	
Diesel Oil	47.6	36.5	29.2	32.7	29.8	25.1	19.2
Heating Oil	17.4	24.3	34.0	30.0	39.8	33.9	63.4
Residue	16.5	18.0	12.6	10.2	10.1	27.7	9.4
Dist. Loss	5.0	5.0	4.0	4.5	6.4	6.3	2.1

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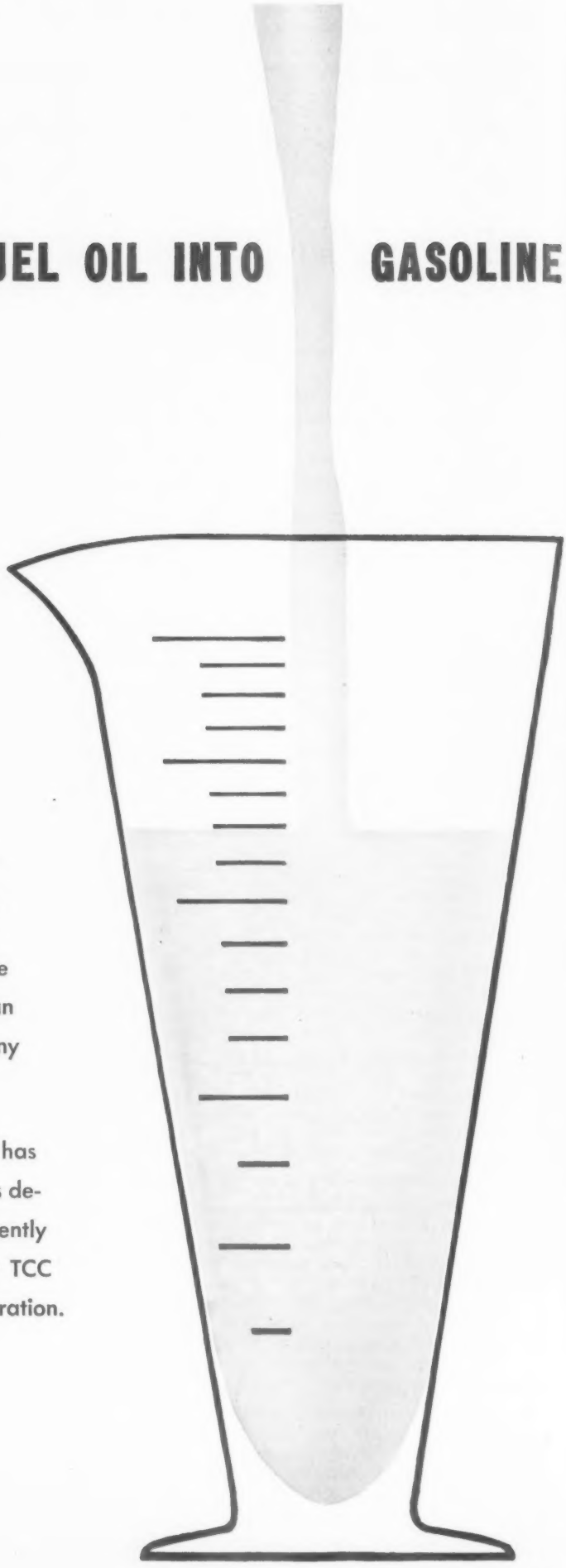

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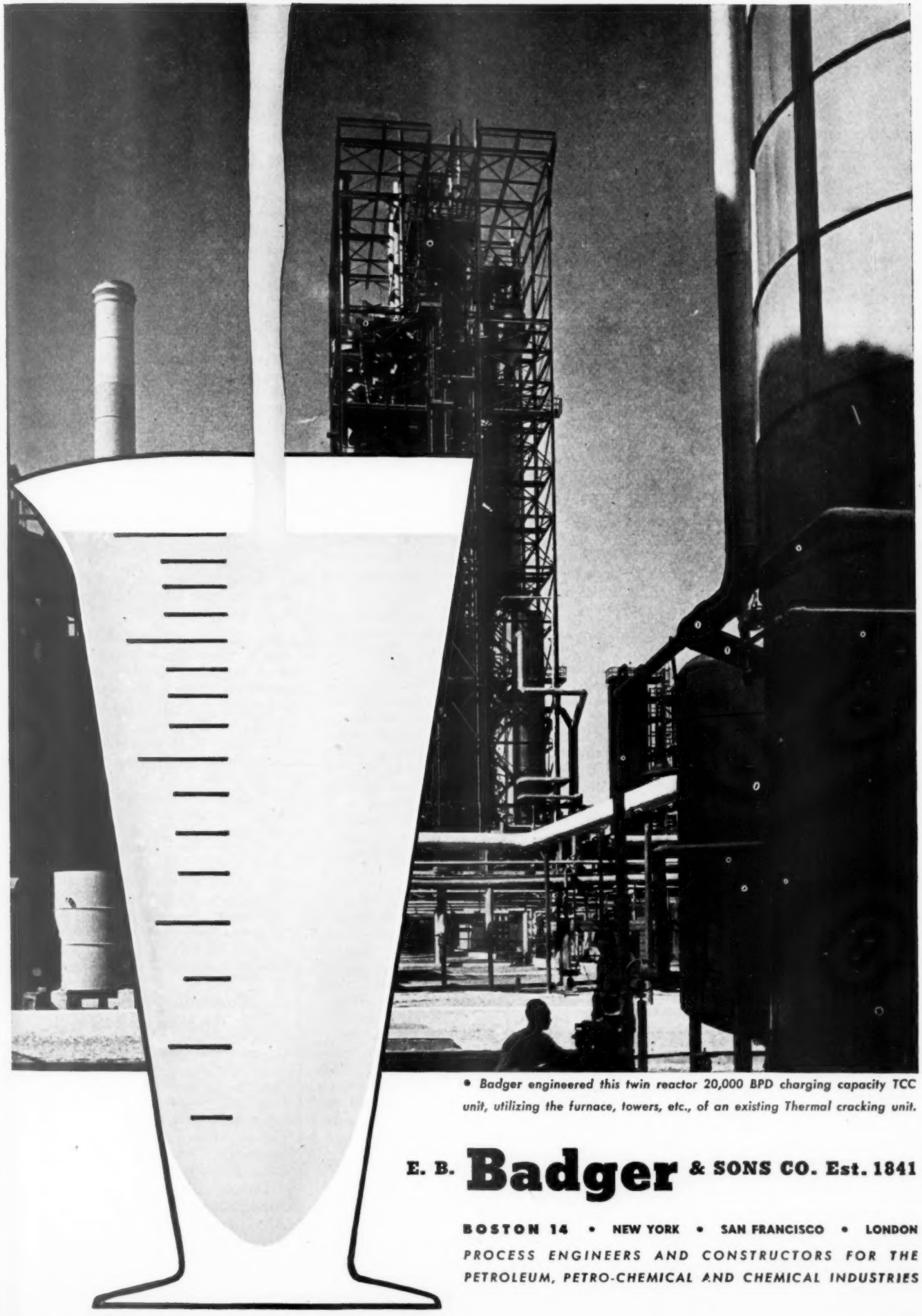

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TABLE 4—Data on Finished Diesel Oils Produced from L-T-C Tar

	L-T.C.Tars From Central Germany				Hessian District	Sudeten District	Tar From Pressure Gasification
	1	2	3	4			
D_{70}	0.815	0.837	0.857	0.868	0.840	0.876	0.845
Viscosity, Say. Sec. at 20° C.	53.7	49.0	54.1	67.7	50.1	65.1	51.6
Pour Point ° C	—15	—17	—16	—21	—18	—22	—10
Creosote Content	< 0.5	0	0.5	0	0.5		
Cetane Number	58	55	55	48	46.5	40	50
Upper Heating Value kcal/kg.	10,800	10,580	10,640		10,690	10,100	
	Corresponding Heating Oils						
D_{70}	0.996	1.030	1.025	1.029	1.006	1.039	1.020
Viscosity, Say. Sec. at 50° C.	120	86.3	106	109	64.1	197.5	59.2
Pour Point ° C	—25	—25	—27	< —25	—20	—13	< —30
Creosote Content	29	50	36	28	55	34	53
Lower Heating Value kcal/kg.	8750	8560	8600	8700	8580	8660	

whereby it is separated into about equal amounts of raffinate and extract, and the results of experiments on this material agree completely with the conclusions deduced from the tie-lines of the graphical presentation.

The filtrate produced by de-waxing the raffinate contains Diesel oils and lubricating oils of various viscosities ranging from spindle oil to aviation lubricating oil. This recovery of such lubricating oils is the principal difference as contrasted with treatment of L-T.C. tar from brown coal. The automotive lubricating oil has a viscosity of 422 sec. S.U. at 50° C. and can be further separated into two parts of an oil having a viscosity of 209 sec. S.U. at 50° C. and one part of an oil having a viscosity of 633 sec. S. U. at 50° C.

The following table gives percentages by weight of the products which are obtained from the combined crude shale oil:

	% By Wt.
Naphtha	2.0
Diesel oil	24.0
Hard wax	6.0
Soft wax	4.3
Spindle oil	4.7
Neutral oil	7.5
Automobile Lub. oil	2.25
Heating oil	34.20
Pitch	10.0
Combined loss	5.05

Numerical Results from the Separation of Various Crude Tars Produced by Low-Temperature Carbonization of Brown Coal and Properties of the Diesel Oil and Heating Oils So Produced.

Table 3 shows the results obtained from the treatment of L-T.C. tar from brown coals produced in various districts of Germany.

As is shown in the first column, there are some such tars from central Germany which produce up to 50% and more Diesel oil and correspondingly smaller amounts of heating oil, but there are only a few sources of brown coal which give such an L-T.C. tar. The heating oil obtained from tar No. 1 could be still further refined whereby the yield of Diesel oil would be greater and the density of the heating oil so obtained would be above 1.0. In general, it should be said that the distillation portion of this separation of the crude L-T.C. tar was carried out in experimental apparatus which, in comparison with commercial installations, led to high distillation loss and also to high values for the amount of distillation residue. As comparisons with commercial installations showed, better results could be expected in commercial practice.

A few more words should be added relative to the properties of the products obtained by these various procedures for separating L-T.C. tar.

According to the schematic procedure, two Diesel oil components are obtained, one from de-oiling the SO_2 raffinate and the other from naphtha washing the SO_2 extract. The first produces a material with a cetene number between 60 and 75, according to the nature of the tar distillate which is available for treatment. A cetane number for the Diesel oil obtained from the naphtha wash is lower and lies between 35 and 45. The cetane number of the mixture of these two components averages between 48 and 55 for L-T.C. tars from central Germany, and about 40 for tars from the Sudeten district.

The average density (D_{70}) of the mixtures of Diesel oil lie between 0.800 and 0.850, and the viscosities at 20° C. at less than 65.1 sec. S.U. The selective separation can be so conducted that a greater total yield of a Diesel oil having a viscosity of 138.5 sec. S.U. at 20° C. can be obtained. The upper heating value of these Diesel oils lies between 10,600 and 10,800, and the lower heating value is about 10,000 Kcal/kg. The specifications which were set by the German Department of Commerce and by the Army and Navy General Staffs were met in all details.

Table 4 brings together data on the finished Diesel oils produced from L-T.C. tar produced from the various brown coals listed in Table 3.

The heating oil produced by our methods of working could be used as naval fuel oil and corresponds to the specifications set for such material. Most important; it should be noted that the density lies above 1, and the lower heating value was never below 8500 Kcal/kg. The coking number lies between 1.4 and 2.5 and always remains under the stipulated maximum value of 3.0.

The pour point can be lowered to below —20° C. without any difficulty, although a pour point of 0° C. was stipulated. The creosote content depended upon the creosote content of the charge stock; a decrease in the creosote content of the finished heating oil was not stipulated in the specifications which has been set.

Conclusions

The SO_2 raffinate as produced in Germany from the low-temperature carbonization of brown coal was a very light colored product and quite easy to dewax. The heating oil, in which the total creosote became concentrated, and which amounts to 30-60% of the final extract, depending on the creosote content of the charge stock, was especially stable and was miscible in all proportions with other heating oils. The properties corresponded to the specifications made by the German Navy. The only new apparatus which was used was the closed continuous band filter, which was a completely new development.

The filtration by use of the continuous band filter was the most striking part of the whole apparatus and operated almost entirely without any further difficulties.

The wax, especially the hard wax, was obtained in a particularly oil-free state and in higher yields than was possible by previous methods of operation; in spite of this, however, it was fully comparable, in all its properties, with the material formerly obtained, and particularly was it possible to secure a good color by the use of appreciably smaller amounts of sulfuric acid and clay in the after-treatment. Specifications as to melting points could be varied quite widely and any demands made by consumers for special products could be easily satisfied.

Continuous Band Wax Filter Described

The continuous band filter for wax extraction which was an invention of the German Edeleanu organization will be described and illustrated with working drawings in the concluding Article 4 of the series on German solvent extraction developments.

Article 4 will also present the straight-line graph method which the Germans had developed as supplementary to the triangular coordinate diagrams for establishing data on solvent extraction operations.

Newly Developed Process Secures Pure Hydrocarbons from Petroleum

The "Distex" process as developed by University of Texas engineers uses both solvent refining and conventional distillation for separating fractions into narrow range hydrocarbons with very close boiling points. Details are given of laboratory apparatus and procedures used in separating a hexane fraction. A proposed commercial scale method is described.

A VARIATION on extractive distillation for the production of pure hydrocarbons has recently been perfected and now is being patented by John Griswold, professor of Chemical Engineering, University of Texas at Austin. By means of this operation, paraffinic naphthenic or cyclic hydrocarbons may be separated, even though their boiling points may be no more than 2° C. (3.6° F.) apart, it is claimed.

The process utilizes both solvent refining and conventional distillation to effect the separation. It's name, "Distex", comes from a combination of two words "*Dis*tillation" and "*Ex*tractive" and is one of the three general modifications of solvent separation operations now applied to petroleum hydrocarbon fractions: solvent refining, azeotropic distillation and extractive distillation.

The Distex operation consists of fractional distillation in the presence of a selective agent or solvent and is conducted at a temperature in which liquid and vapor phases coexist. The "foreign" component or extractive agent may be any of a number of organic compounds, including most of the selective solvents used in solvent refining. From the standpoint of economic considerations, the solvents which probably will be used industrially are Chlorex, furfural, phenol and nitrobenzene.

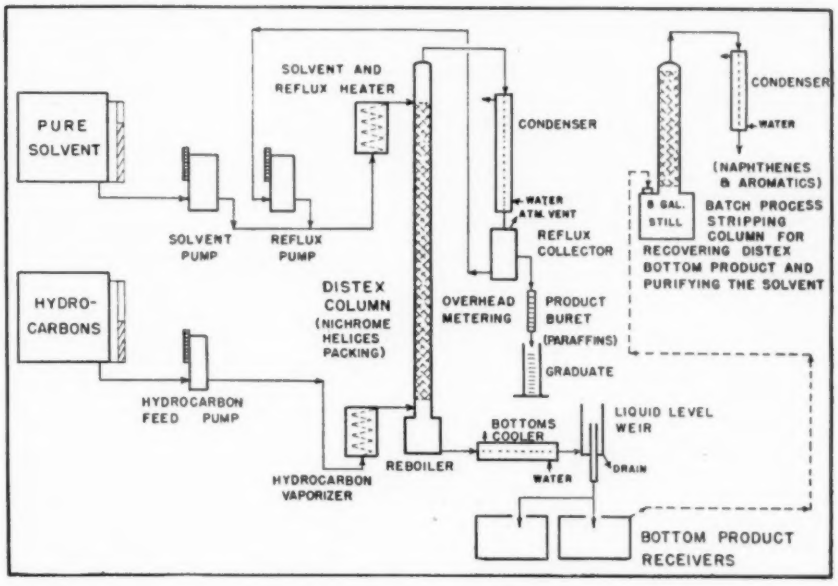

Fig. 1—Flow diagram for laboratory scale Distex process for producing pure hydrocarbons from narrow-boiling mixtures

In preparing the charge a narrow-boiling stock or fraction which contains the desired hydrocarbons is secured by conventional distillation. This stock, containing both the paraffin and cyclic fractions, then is separated into the two types by the Distex operation. Final processing consists of individual fractionations of the two single-type fractions into their respective components. The type-separation was found to be nearly independent of the molecular weight or boiling point of the compound, and extract and raffinate portions consist of materials having both low and high hydrogen-to-carbon ratios. The inventor states this operation is therefore uniquely suited to the treatment of materials of light boiling range such as paraffin, gasoline, or naphtha fractions.

The principal difference between azeotropic distillation and Distex is that in azeotropic a solvent must be selected whose boiling point is close to that of the material to be separated. But in the Distex separation, the boiling point of the solvent is unimportant so long as it is well above that of the hydrocarbon. Thus Distex has one more degree of freedom than does azeotropic distillation, since the phase compositions are not fixed either by temperature or pressure alone and this permits the solvent in the liquid reflux to be maintained at a desired optimum concentration.

Some idea of the complexities involved in separating narrow range hydrocarbons by conventional distillation is indicated by the fact that many of them have almost identical boiling points. For example, cyclopentane and neohexane boil

TABLE 1—Distex Tests on 48-in. Enriching Column

Run No.	Sample No.	Mole % N-Heptane Feed	Mole % N-Heptane Distillate	Reflux Ratios—Actual	Reflux Ratios—Theoretical Minimum*	Theoretical Plates†
		n-Heptane-Methylcyclohexane in 87 Mole-% Aniline[1]				
21	..	25.4	97.2	33	8.3	7.8
22	..	15.3	95.4	35	13.3	12.4
	1	18.8	69.0	11	7.0	8.0
23	2	18.8	82.8	19	9.1	9.8
	3	18.8	85.8	22	9.6	9.0
	4	18.8	93.8	80	10.8	12.3
	1	16.7	94.6	35	12.3	12.8
24	2	16.7	95.9	46	12.5	13.8
	3	16.7	96.6	∞	13.2	12.9‡
25	1	18.7	88.0	18	10.0	11.6
	2	18.7	96.5	∞	11.3	12.4‡

Sample No.	Liquid Rate at Top of Column, cc/min.	Mole-% N-Heptane Still Pot	Mole-% N-Heptane Distillate	Theoretical Plates‡	HETP, Inches
	Efficiency Test, Binary Hydrocarbon Mixture, No Solvent[2]				
1	15	41.6	76.0	18.5	2.6
2	28	41.9	76.0	18.4	2.6
3	36	42.9	75.7	17.5	2.7
4	42§	43.2	72.6	15.3	4.1

*From Smoker nomogram (Ind. Eng. Chem. 34,509, 1942).
†From Smoker equation (Trans. Am. Inst. Chem. Engrs. 34,165, 1938).
‡From Fenske equation for total reflux (Ind. Eng. Chem. 35,117, 1943).
§Rate of incipient flooding.
[1] Aniline-free basis; relative volatility (α) 1.47
[2] Total reflux; relative volatility (α) 1.08

0.2° apart, and benzene forms minimum-boiling azeotropes with the paraffins and naphthenes whose boiling points are somewhere near 80° C.

A straight-run C_7 fraction may contain a number of pairs of hydrocarbons whose boiling points are within 1° C. of one another. C_6 and C_7 naphthenes and aromatics boil higher than some C_7 and C_8 paraffins and naphthenes. Toluene forms non-ideal solutions with non-aromatics whose boiling points are near 110° C. and abnormally low relative volatilities occur in toluene-non-aromatic primaries, always at high concentrations of the lower-boiling component. This makes it virtually impossible to fractionate a small amount of toluene from lower-boiling non-aromatics, or to fractionate out small amounts of higher-boiling non-aromatics from toluene.

Laboratory pilot plant operation was carried out at the University of Texas, with aniline as the solvent because, for laboratory purposes, most of the other solvents were objectionable because of fire hazard or danger to personnel. The column consisted of an enriching section with the equivalent of one equilibrium stripping contact furnished by the reboiler. Packed section contained 48 in. of ⅛ in. by 22-gage one-turn Nichrome helices. Flow-rate control was by variable speed drive to the separate solvent, reflux and feed pumps, and also by changing the gears driving the pumps.

A flow-diagram for the pilot plant is shown in Fig. 1. Hydrocarbon charge is vaporized, entering the column just above the reboiler. Bottoms leaving reboiler are cooled and collected in the receiver. They consist largely of cyclic hydrocarbons and solvent, the latter being stripped before bottoms are fractionated. Overhead vapors are completely condensed, part being removed as product and the balance returned as reflux with the fresh solvent, entering at the top of the packed section following preheating. Separation is completed by conventional fractionation.

Tested under Distex operation with n-heptane-methylcyclohexane-aniline mixtures, the results shown in Table 1 were secured. The number of equivalent theoretical plates with and without solvent was determined and, in the case shown, number of equivalent theoretical plates for Distex operation with aniline is approximately two-thirds that with the hydrocarbons alone.

The tower then was tested with a hexane fraction separated from "Skellysolve B" whose A.S.T.M. boiling range was 148 to 165° F. This material was charged to the Distex column, operated with a hydrocarbon reflux ratio of about 13 and at a solvent rate that maintained slightly more than 80 mole-% aniline in liquid reflux. Overhead products amounted to approximately 60% charge, and was almost entirely paraffinic. Bottoms contained all the cyclohexane and benzene, and all but 3.5% of total methylcyclopentane present. Benzene was removed from bottoms by nitration, with overhead and bottoms products separately fractionated subsequently.

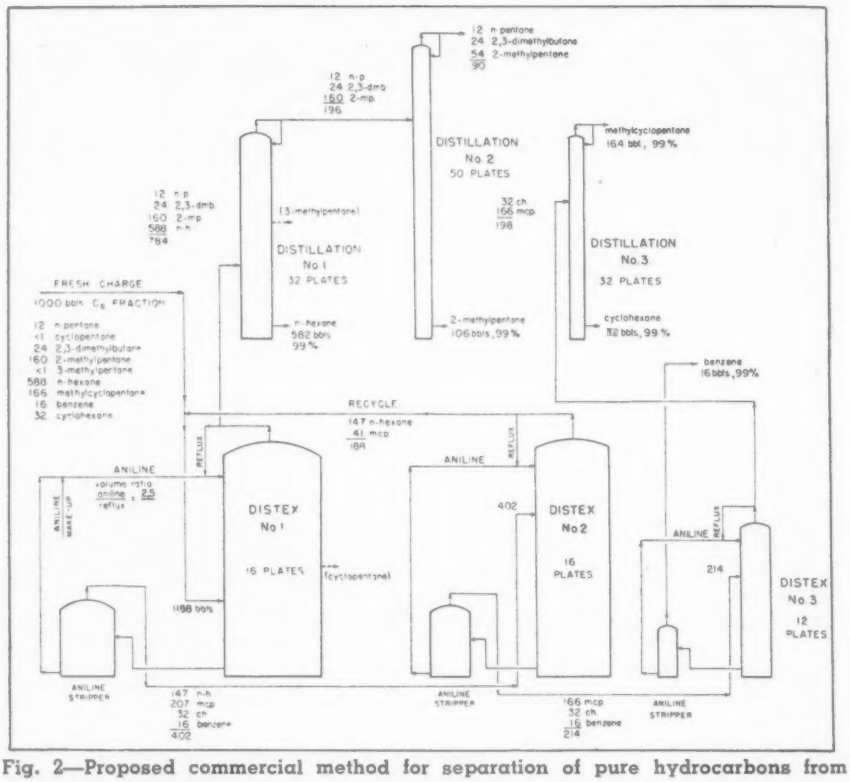

Fig. 2—Proposed commercial method for separation of pure hydrocarbons from C_6 fractions by Distex process. Theoretical plates at total reflux are given. Material balance in bbls. based on 1000 bbls. of charge

Complete analyses of the Distex fractions is given in Table 2.

A schematic flow-sheet (Fig. 2) for a commercial-sized plant has been developed, using "Skellysolve B" as an example, for the separation of principal hydrocarbons in purities of 99% or better.

Figures in the diagram are based on fresh charge of 1000 bbls. of C_6 fraction. Flow is quite similar to that of the preceding Fig. 1, entering through vaporizer (not indicated) above reboiler in Distex No. 1 column. The small amount of cyclopentane contained in this stream may be disposed of as a side-stream bleed from Distex No. 1, where it accumulates. Overhead consists of n-pentane, 2,3-dimethylbutane, 2-methylpentane, a small amount of 3-methylpentane and n-hexane; bottoms of aniline (solvent) and n-hexane, methylcyclopentane, cyclohexane and benzene. The minor paraffins are not separated.

Bottoms, after being stripped of solvent, constitute charge to Distex No. 2, while overhead is charged successively to Distillation Nos. 1 and 2 columns for separation of paraffins. Overhead from Distex No. 2 is recycled to fresh charge entering Distex No. 1, while bottoms, after again being stripped of solvent, are charged to Distex No. 3.

Overhead from Distex No. 3 is charged to Distillation No. 3 for separation into methylcyclopentane and cyclohexane of 99% purity; benzene and aniline, bottoms from Distex No. 3, are separated in the stripper to purities of 99%.

TABLE 2—Summary of Fractional Distillation(*) of Aniline Raffinate and Extract Products from "Hexane" Fraction

% by Volume	Overhead		Bottoms		Total Individual Component in:		Final
Compound	Sample	Original Fraction	Sample	Original Fraction	Raffinate	Extract	Analysis
n-Pentane	2.0	1.2	0	0	100	0	1.2
Cyclopentane	0	0	0.6	0.2	0	100	0.2
2, 3-Dimethylbutane	4.0	2.4	0	0	100	0	2.4
2-Methylpentane	24.0	14.4	4.0	1.6	87	13	16.0
N-Hexane	69.0	41.4	43.4	17.4	70	30	58.8
Methylcyclopentane	1.0	0.6	39.5	15.8	3.5	96.5	16.4
Cyclohexane	0	0	8.0	3.2	0	100	3.2
Benzene	0	0	4.5†	1.8†	0	100	0

*In 11 mm by 36 in. Podbielniak column with "Heli-Grid" packing.
†Value by nitration of aniline extract before fractional distillation.

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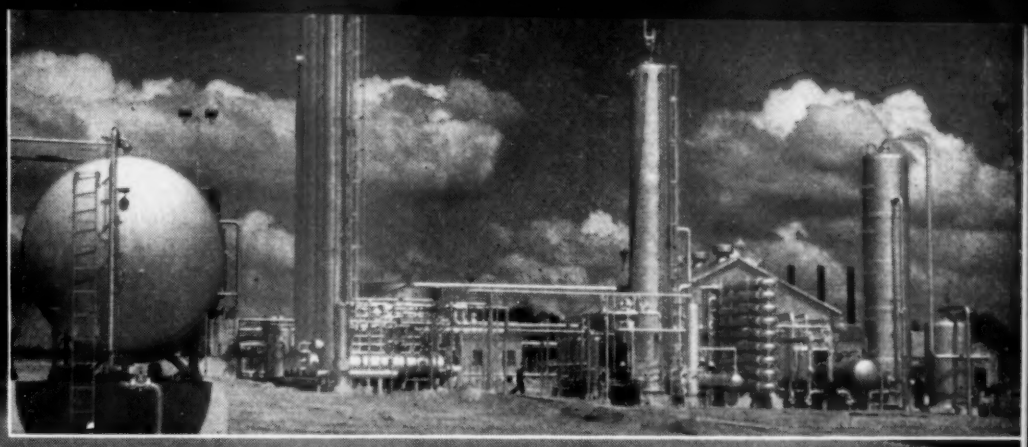

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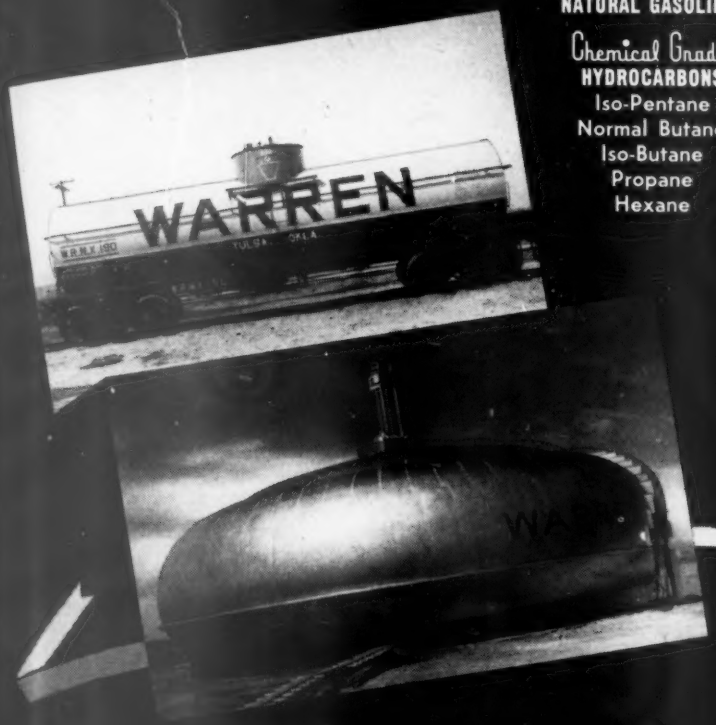

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Cracking of Heavy Petroleum Stocks Over Heated Surfaces

By A. Ya. Larin

Institute of Mineral Fuels, Academy of Science U.S.S.R.

Experiments of cracking of oil distillates over electrically heated metallic spirals established that a gas is produced under these conditions of a composition approximately identical with that obtained from paraffin wax. However, the yields of gas per unit energy consumed are the lower, the richer is the charge in compounds with a low hydrogen content. An oil distillate consisting essentially of naphthenes gives a yield of gas per kw.-hour which is half that obtainable from paraffin wax. An oil distillate containing up to 21% aromatics gives about one fourth of the amount of gas obtainable from paraffin wax. From fuel oils the yields of gas obtained are still lower and show pronounced fluctuations, depending upon the contents of resins and carboids in the charge.

HEAVY paraffin hydrocarbons obtained from carbon monoxide and hydrogen (kogasin) are known to decompose under the action of a heated wire spiral immersed in them, forming a gas abundant in olefins. This method of decomposition was used in experiments of cracking of heavy oil charges containing, along with paraffins, also naphthenes and aromatics, as well as heavy resinous substances which easily undergo coking. The experiments are of practical interest in view of the suitability to a number of chemical industries of this method of conversion of heavy oil components to gases with high contents of olefins.

Method and Apparatus

The experiments were carried out in apparatus of continuous action in which the spirals could be changed without interrupting the process and dismounting the equipment. The setup is shown in Fig. 1. The flask (1), made of pyrex glass and containing the charging stock, was kept in the electrically heated furnace (2), in which observation slits were made on the sides. Into this flask 4-5 electrodes were placed, kept in position with the aid of the rubber stopcock (3) and fitted with spirals (4) heated by a 120-volt alternating current.

Vigorous gas formation was observed on the surface of the heated spiral in contact with the oil, and the bubbles of the gas with liquid distillate were passed into the condenser system (5), consisting of an air condenser and a water-cooled condenser, a receiver for the liquid products (6) and traps (7) kept in Dewar vessels with liquid air. The uncondensed gas, consisting mainly of hydrogen and methane, was discharged through the gas meter (8) into the atmosphere.

In the course of cracking, the surface of the spiral was gradually covered with carbon and this interrupted the cracking. By directing the electrical current with the aid of the contact switch (9) to a new spiral, the process could be continued until the entire charge was cracked or all spirals became covered with carbon.

The consumption of electrical current was followed up by readings of an ammeter, voltmeter and a wattmeter. The potential difference varied from 20 to 50 volts. Fig. 2 shows the wiring: (1) is a rheostat, (2) current meter, (3) ammeter, (4) voltmeter, (5) switch, (6) heating spirals.

The gas condenser in the traps was determined by its evaporation into a gas holder or by passing through the gas meter. It was sampled in the course of the experiment. The unsaturated components of the gas, beginning with pro-

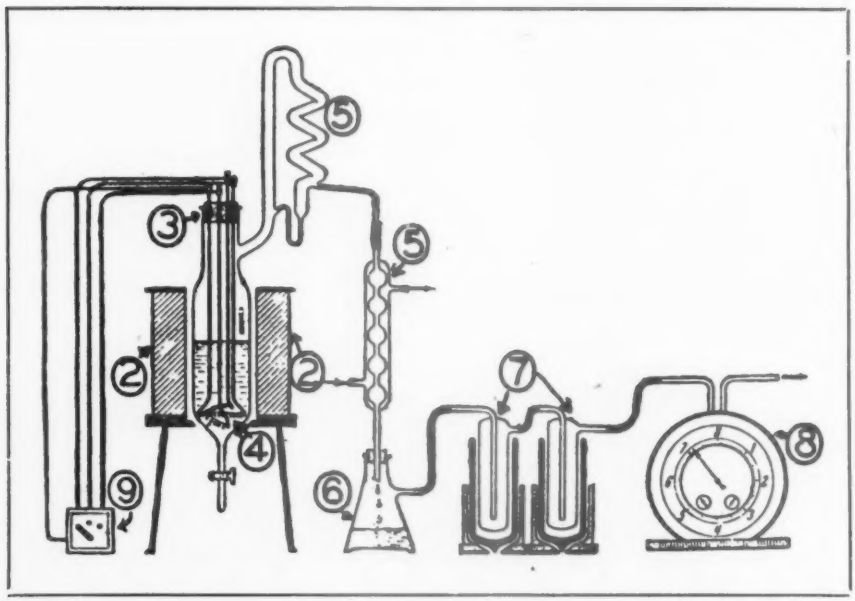
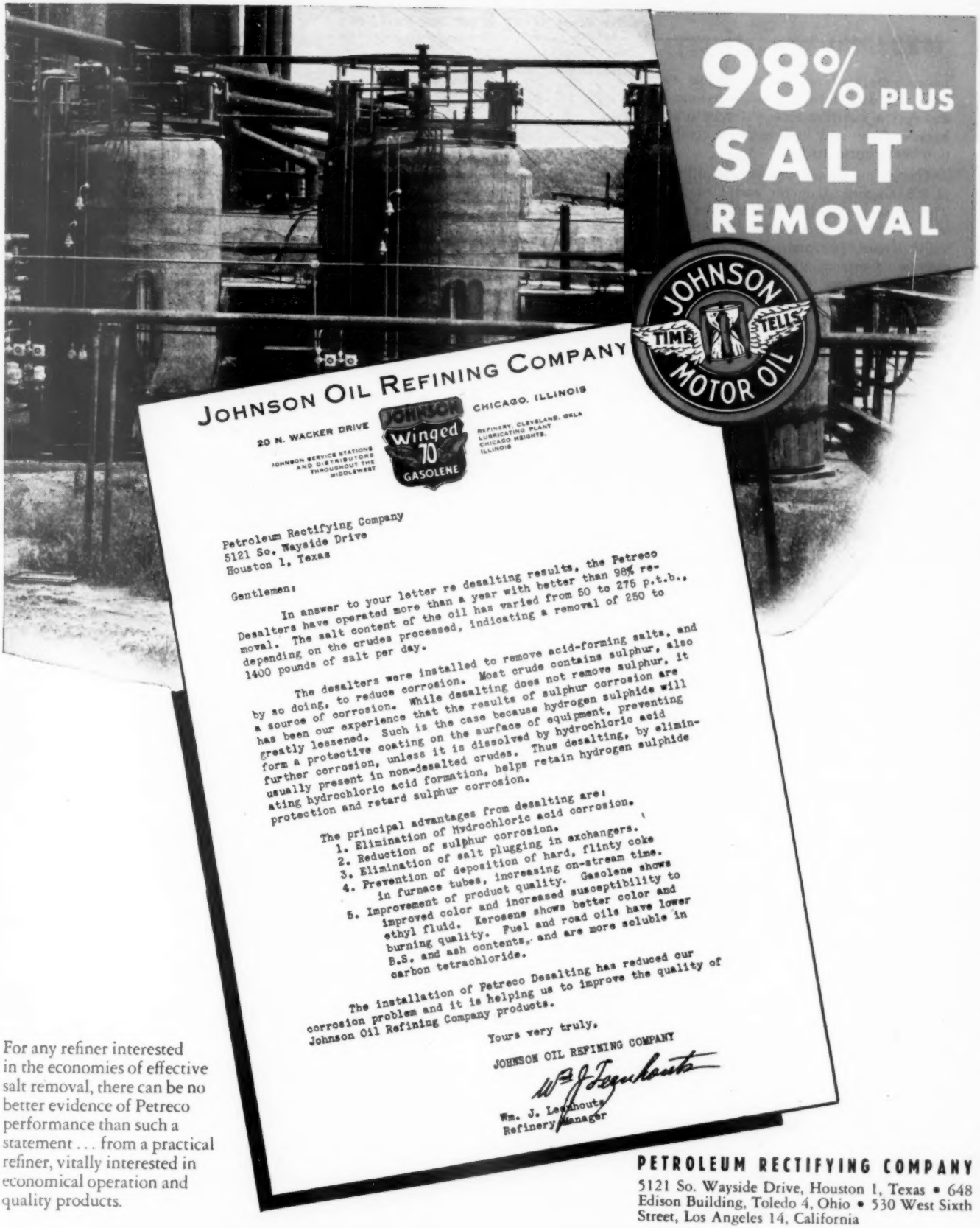


Fig. 1—Apparatus for cracking paraffin hydrocarbons over electrically heated spirals. The spirals are shown at point 4; other parts of the equipment are identified in the accompanying text

This article is one in a series of translations from Russian scientific literature being published in the NPN TECHNICAL SECTION. The current article originally appeared in "Izvestiya Akademii Nauk S. S. S. R., Otdelenie Tekhnicheskikh Nauk" (Bulletin of the Academy of Sciences, U. S. S. R.), 1944, no. 1-2, pages 42-47.

Translation is by Dr. J. G. Tolpin, Universal Oil Products Co., Chicago, and is made available through the Petroleum Division of the American Chemical Society. Facts and opinions presented are solely those of the original authors and neither U. O. P. or A. C. S. necessarily endorses the statements made.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pene, were analyzed by absorption with 68% and 84% sulfuric acid, ethylene by absorption with bromine water, saturated hydrocarbons and hydrogen by combustion over cupric oxide.

The spirals used were made of wire of 0.5-0.8 mm. diameter and 1 m. long. The spiral turns had a diameter of 8 mm. The wires were made of tungsten, molybdenum, platinum, iron, nickel, nichrome, German silver or constantan. The temperature to which the spirals were heated reached 800-1000° C. and was measured by a nichrome-constantan thermocouple welded to the middle of the spiral.

Experimental Results

Paraffin Wax—In the first series of experiments paraffin wax was cracked with the aid of a nichrome spiral. With the increase of the current from 20 to 35 amp., the yield of gas rose from 68 to 80% on the product decomposed. The amount of the liquid products formed accordingly dropped from 31 to 19%, while the content of olefins in the gas rose from 45 to 78% by volume and that of paraffins decreased from 25 to 8%. The content of hydrogen was more or less uniformly 6-8%. The carbon formed was invariably low, and amounted to 0.5-1.0% on the charge cracked.

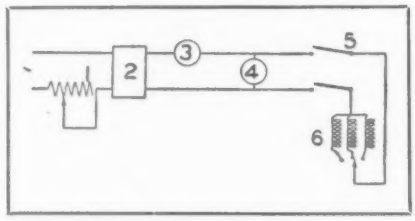

Fig. 2—Wiring diagram for measuring the current consumption during the experimental cracking operations

In experiments with spirals made of constantan, German silver, nickel, iron, tungsten, molybdenum and platinum it was found that the first four metals enumerated brought about extensive coking and rapid decrease of the yield of gas, accompanied by destruction of the metal. With tungsten, molybdenum and platinum, the highest yields of gas were obtained, when calculated on the electrical energy consumed, and this gas contained a substantial amount of unsaturated compounds. For instance, with tungsten the amount of paraffin wax decomposed reached in individual experiments 500 g. per kw.-hr. the gaseous products amounting to 80% on the charge decomposed and containing up to 78% unsaturated compounds.

Molybdenum exerts a lower cracking effect in comparison with tungsten, but exceeds the latter in its thermal stability, for tungsten after the experiment was

TABLE 1—Comparison of Yields from Paraffin Wax and Kogasin When Cracked Over Electrically Heated Spirals

Expt. No.	Material of the Spiral	Current Strength, Amp.	Duration of the Expt. hr.	min.	g. Charge Decomposed per kw. hr.	Cracked Products: g. gas per kw. hr.	% gas on the charge	Liquid distillates % on charge	Composition of the gas: $C_nH_{2n}+2$	C_nH_{2n}	H_2	Composition of the Unsaturated Portion of the Gas: C_2H_4	i—C_4H_8	n—C_3H_6
						Bleached paraffin wax, m.p. 53°								
22	w	20	1	30	(96)	(87)	91	9	11	81	6	49	0,5	32
23	w	22	2	25	(126)	(101)	80	20	..	80	..	..	..	..
17	w	25	1	25	(350	(280)	78	22	..	90	..	..	4,1	4
35	w	26,5	0	55	(382)	(263)	69	31	..	78	..	..	..	..
50	w	26	0	25	400	240	60	40	..	..	..	..	..	..
31	Mo	24	0	40	(253)	101	60	40	..	76	..	54	0,5	22
39	Mo	28	0	50	428	224	52	48	..	90	(7)	68	1.6	20
24	Fe	20	1	30	(106)	(71)	67	33	..	87	..	56	0,2	31
26	Fe	23	0	45	(161)	(125)	78	22	..	..	..	..	..	..
33	Ni	22	0	45	(164)	(112)	67	32	13	79	4	55	0,2	24
42	Pt	26,5	1	10	(347)	(259)	74	26	..	62	..	23	1,0	38
						Kogazin								
	Fe	19	0	45	147	126	86	13	..	63	2	..	..	..
	Ni	34	1	10	145	120	83	17	..	79	5	..	..	..
	Pt	15	0	50	240	200	82	18	..	74	8	..	..	..

TABLE 2—Comparison of Yields in Mazut Cracking Experiments

Charge	Expt. No.	Material of the spiral	Current Strength, A	Duration of the Experiment hrs.	min.	g. charge decomposed per kw. hr.	Cracked Products: g. gas obtained per kw. hr.	% gas on the charge	Liquid Products % on charge	Composition of the gas: $C_nH_{2n}+2$	C_nH_{2n}	H_2	Composition of the unsaturated portion of the gas: C_2H_4	i-C_4H_8	n-C_3H_6
Grozny mazut with i.b.p. 205°, a combined sample freed of carboids and resins	28	W	35	1	15	(39)	(23)	58	42	..	..	..	..	..	..
	29	W	43	1	35	(13)	(9)	70	30	27	48	12	39	0,9	9
Mazut from Grozny wax-bearing oil obtained by laboratory distillation under atmospheric pressure; boiling range, 325-450°; content of aromatics, 13%; naphthenes, 70%; paraffins, 17%	30	W	35	1	00	(88)	(45)	52	48	..	69	..	36	3,5	29
	32	Mo	38	1	00	(78)	(28)	35	65	..	30	..	22	0,6	7
Mazut from Zykh oil obtained by vacuum distillation up to 216° (in the vapors) under 60 mm. pressure; content of aromatics, 30%; naphthenes, 46%; paraffins, 24%	44	Mo	26	1	05	(186)	(58)	31	69	20	56	9	35	..	21
	45	Pt	24	0	50	(325)	150	46	54	..	51	..	34	2,2	15
	52	Pt	22	0	25	427	178	41	59	..	68	(6)	40	3,4	25
Mazut from Kara-Chukhur oil from the Stalin refinery in Baku freed of the portion boiling up to 325° under atmospheric pressure; content of aromatics, 15%; naphthenes, 49%; paraffins, 36%	46	Pt	27	1	00	189	73	39	61	34	44	10	32	..	12
	47	W	30	0	30	308	123	39	61	30	50	(9)	39	0,4	11
	48	Mo	33	1	00	171	92	53	47	27	63	(14)	42	0,8	20
	51	W	30	0	40	222	87	39	61	..	64	(9)	45	2,0	17
Lube oil of Grozny wax-bearing oil distilled in vacuum; boiling range, 325-460°; content of aromatics, 21%, naphthenes and paraffins, 79%	41	W	35	1	20	101	78	79	21	16	78	16	37	4,0	37
	38	W	40	1	15	(135)	(98)	73	27	..	..	..	..	..	..
	34	W	40	0	55	(126)	(90)	73	27	25	69	10	44	3,1	22
	40	Mo	26	1	00	(270)	140	51	49	11	68	(9)	18	2,8	47
	43	Pt	26	0	55	(186)	107	57	43	12	68	(10)	40	0,2	28
Lube oil distillate deprived of aromatics with sulfuric acid	49	W	35	1	00	198	131	66	44	..	82	(8)	51	0,6	30

TABLE 3—Comparison of Yields From Three Different Charge Stocks Cracked Over a Tungsten Wire

Expt. no.	Charge	g. charge decomposed per kw. hr.	g. gas obtained per kw. hr.	% gas obtained	% unsaturated in the gas
41	Unrefined lube oil distillate	101	78	79	78
49	Lube oil distillate treated with sulfuric acid	198	131	66	82
35	Paraffin wax	382	263	69	78

very brittle and easily broke down. In addition, molybdenum is distinguished by a lower coking effect.

Platinum is thermally stable, but decomposes a smaller amount of charge than tungsten, other conditions being equal. Thus, over platinum 350 g. paraffin wax were cracked per kw.-hr., while over tungsten, 400 g. The amounts of gaseous products were the same in both cases up to 75% on the charge, and they contained up to 78% olefins. The data shown in Table 1 indicate that the results of cracking paraffin wax are generally close to those obtained in cracking kogasin, according to literature data.

Mazut — A mixed sample of mazut produced in a commercial unit from Grozny wax-bearing oil was used in these experiments, without freeing it of carboids and asphaltenes. Nichrome and tungsten spirals were employed for heating and showed pronounced coking. Within 10-15 minutes the coke coated the heating spiral with a continuous film and hindered contact of the product with the heated surface, thus greatly reducing the cracking process. The duration of cracking of mazut after carboids and resinous substances were removed by the method of Marcusson, i.e., by dissolving the mazut in petroleum ether, followed by filtration and distilling off the lighter portion of the product, reached 1 hour and more, and yielded up to 58% gas on the charge cracked.

When a sample of unrefined mazut was cracked prepared in the laboratory by distillation of Grozny crude of high wax content up to 325° C., considerably better results were obtained in comparison with those of cracking the mixed sample of the plant-produced mazut.

Mazut from Zykh wax-bearing oil from the upper horizon gave still better results, and the amount of charge decomposed per kw.-hr. could be brought up to 427 g., giving a yield of gas of about 40% on the charge decomposed. The content of olefins in the gas reached 71%. In cracking of Zykh mazut, virtually no coking was observed. Mazut from Kara-Chukhur oil was also cracked without noticeable coking; however, the yield of gas per unit energy was somewhat lower than for Zykh mazut.

A conclusion is warranted by the mazut cracking experiments that the carboids in this charge hinder its cracking on a heated wire. The yields of gas and the content of olefins in the gas obtainable from mazuts freed of carboids and asphaltenes are still lower than those of cracking of paraffin wax (Table 2). Apparently, aromatics and naphthenes, in addition to carboids, also hinder the decomposition of the charge.

Lubricating Oil Distillates — Experiments with this type of charge aimed at further clarification of the parts played by aromatics and naphthenes in the process studied. The oil distillate cracked came from Grozny wax-bearing oil which was distilled up to 325° C. for its preparation. This was followed by a vacuum distillation under 12 mm. pressure at 285°, which corresponds to a boiling range of the distillate from 325 to 460°. A dark, but transparent, oil was obtained with a small amount of wax thrown out of solution which was not removed in the experiments. Spirals from tungsten, molybdenum and platinum were used and molybdenum gave the most favorable results with respect to the amount of charge decomposed per kw.-hr: up to 270 g., against 185 g. for platinum and 101 g. for tungsten. With the last-mentioned metal up to 80% gas on the charge was obtained at a current strength of 35 amp. For molybdenum, the yield of gas was 51% and for platinum 57%.

The results shown in Table 3 serve for comparison of the three types of charging stocks treated in the presence of a tungsten wire spiral. The content of naphthenes and aromatics in the stock affects only the yields of gas per unit energy spent, but exerts little effect on the yields of gas on the charge decomposed or the content of olefins in the gas.

This work was carried out under the general direction and with the advice of A. V. Frost. The gas analyses were carried out by V. Aristarkhova and L. Kancheeva.

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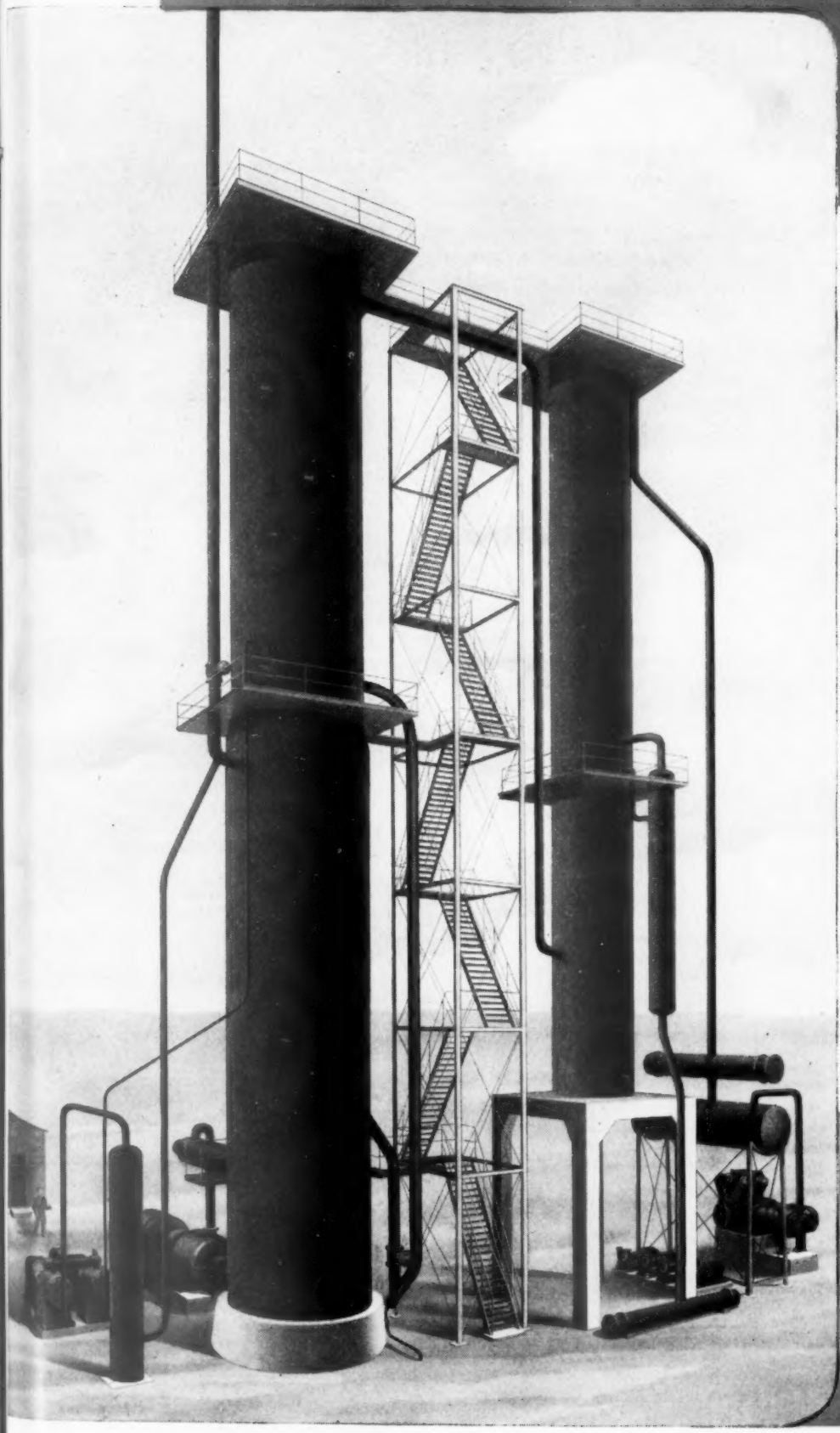

Proper Classification of Wastes First Step in Disposal Program

Article 4 in a Series

By W. B. Hart

In charge of Waste Disposal for Atlantic Refining Co.

Refinery wastes from modern processing are classified by chemical and physical nature, since such listing is most important fundamental information to the plant operator planning for the systematic and efficient disposal of his waste materials. Overlapping of the characteristics of certain classes of wastes is shown to complicate the problem of their treatment. It is important that storm water waste should be included in planning a disposal system.

Oil itself forms a considerable part of the waste at many plants, due to a great extent to carelessness of operators. Its presence not only represents a loss of valuable material to the refinery but frequently adds to the disposal problem by creating emulsions which are difficult to treat.

BEFORE there can be useful understanding of the problems encountered in the treatment and disposal of petroleum refinery wastes, well-organized information about what kinds of wastes occur should be obtained. Also there should be fairly complete data for the processes which produce the wastes. This should include whether any waste is produced continuously or intermittently; how it enters the refinery drainage system, and in what quantity.

A classification of wastes, enumeration of their sources and description of their general nature will aid in distinguishing the various kinds and indicating how general is their occurrence.

The principal characteristics of refinery wastes largely depend upon the processing methods practiced, and to a lesser extent upon the crude oil processed. There is wide variety in processing. For example, a topping plant may operate without any intricate procedures, producing very simple wastes which will require perhaps only little treatment, particularly if a "sweet" crude is being run.

On the other hand, a large complete refinery will produce wastes of the same general nature as the topping plant, and also a variety of others. Thus, the character of the wastes, and not the process which produces them, is the best basis for classification. This will become even more apparent when treatment methods are discussed. Such a classification is presented in Table 1. The usual sources of the various kinds of wastes are shown in Fig. 1.

It is important at this point to indicate the difference between the terms "waste" and "waste waters." They are used largely as a matter of convenience and there often is little technical difference between them. Most wastes from refinery processes are in liquid (i.e., aqueous solution) form. "Waste" is used to describe the liquid form as it leaves the particular process which produces it, and enters the general plant drainage system. The term "waste waters" is used to describe the discharge of the general drainage system to the receiving surface water, either through separators or otherwise. It is important to remember that the waste waters may contain several wastes.

Examination of Table 1 may lead to the conclusion that each class of wastes is clear cut and distinct from all others. This is not true, for there is marked overlap of characteristics. For example, an acid waste also may be toxic and may carry taste and odor. But its principal characteristic, because of its usual and perhaps best known effect, is acidity. Therefore it is so classified. Many wastes also absorb dissolved oxygen. This is a highly undesirable characteristic, and receives class rating, although the wastes otherwise could be included in other classes.

Each class of wastes will be discussed separately. Further discussion of refinery wastes has been presented by Hart [26, 27], Hill [28], Burroughs [29], Weston and Hart [30], Weston [31], and Hart [32]. See also [11].

Uncontaminated Water Waste

Under normal operating conditions 85 to 95% of the water used in petroleum refineries is applied for cooling purposes and in its application it is practically unchanged in quality. The only change is one of temperature. In regions where water is plentiful a "once-through flow" usually is practiced unless recirculation over cooling towers is carried on for some special reason. The waste waters of refineries in such regions consist largely of this cooling water, which, in itself, may be uncontaminated. Where a separate drainage system is used to carry off this waste for discharge to the receiving surface waters the waste normally retains its uncontaminated character. But where a single sewer or drainage system serves the entire refinery, the cooling water waste usually becomes contaminated by the wastes of many other processes.

In some sections, water is relatively scarce and must be conserved by reuse.

TABLE 1—Refinery Wastes Classified on the Basis of Their General Characteristics*

(1) Uncontaminated water waste
(2) Storm water waste
(3) Oil and oily wastes, including emulsions
(4) Wastes which affect hydrogen ion concentration, acidity, and alkalinity
(5) Wastes which absorb dissolved oxygen
(6) Wastes which cause taste and odor
(7) Toxic wastes
(8) Wastes which are highly concentrated solutions of mineral matter (i.e., carry high dissolved solids)
(9) Wastes which carry suspended solids and are turbid.
(10) Colored wastes
(11) Minor miscellaneous wastes
(12) Semi-solid and solid wastes**

*Waste gases and vapors are omitted from this table. They will be treated separately.

**Included here for convenience as they are only partly related to liquid wastes. They will be treated separately.

Fig. 1
WASTES
OF
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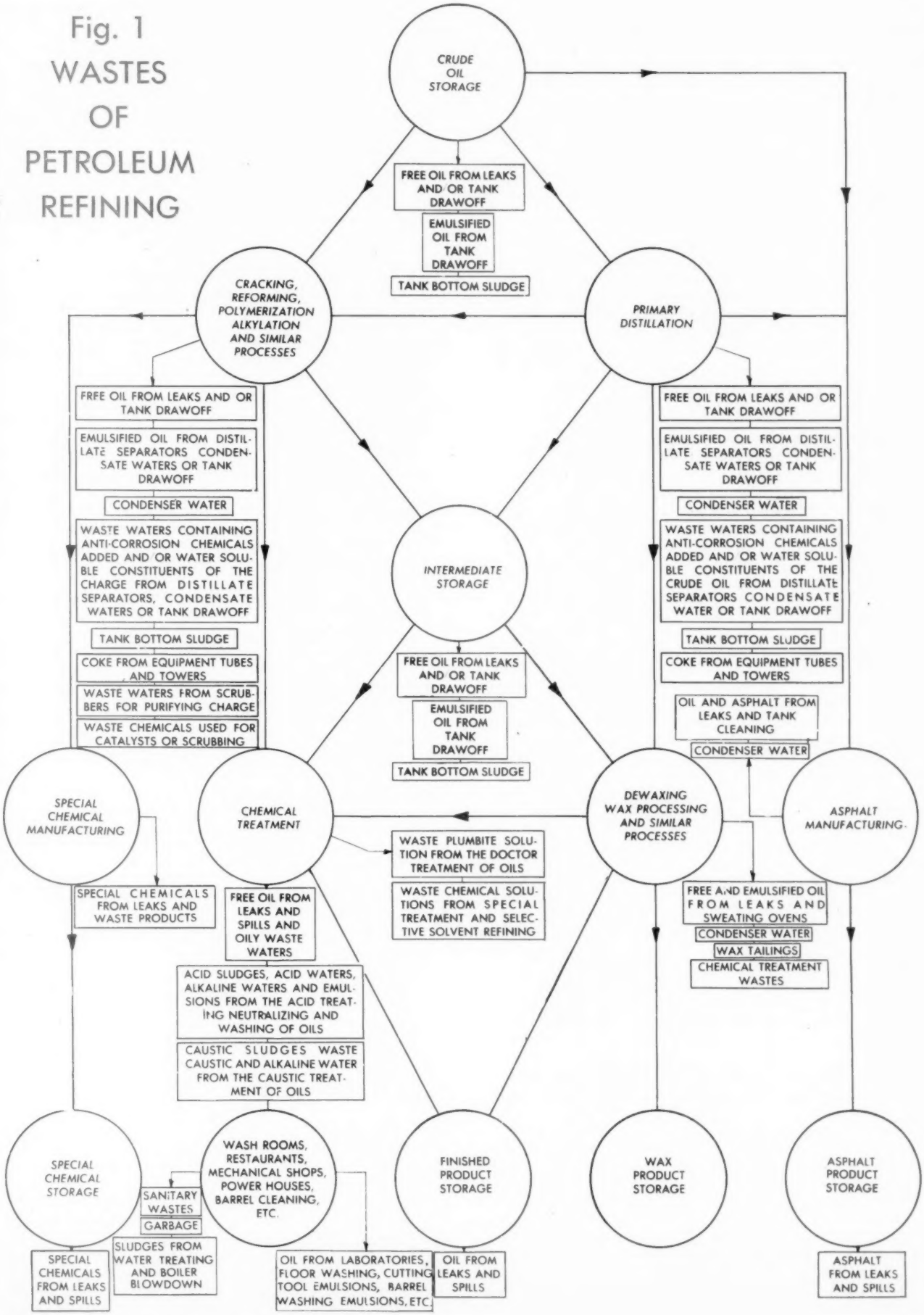
REFINING


CRUDE OIL STORAGE
FREE OIL FROM LEAKS AND OR TANK DRAWOFF
EMULSIFIED OIL FROM TANK DRAWOFF
TANK BOTTOM SLUDGE
CRACKING, REFORMING, POLYMERIZATION ALKYLATION AND SIMILAR PROCESSES
PRIMARY DISTILLATION
FRFE OIL FROM LEAKS AND OR TANK DRAWOFF
EMULSIFIED OIL FROM DISTILLATE SEPARATORS CONDENSATE WATERS OR TANK DRAWOFF
CONDENSER WATER
WASTE WATERS CONTAINING ANTI-CORROSION CHEMICALS ADDED AND OR WATER SOLUBLE CONSTITUENTS OF THE CHARGE FROM DISTILLATE SEPARATORS, CONDENSATE WATERS OR TANK DRAWOFF
TANK BOTTOM SLUDGE
COKE FROM EQUIPMENT TUBES AND TOWERS
WASTE WATERS FROM SCRUBBERS FOR PURIFYING CHARGE
WASTE CHEMICALS USED FOR CATALYSTS OR SCRUBBING
FREE OIL FROM LEAKS AND OR TANK DRAWOFF
EMULSIFIED OIL FROM DISTILLATE SEPARATORS CONDENSATE WATERS OR TANK DRAWOFF
CONDENSER WATER
WASTE WATERS CONTAINING ANTI-CORROSION CHEMICALS ADDED AND OR WATER SOLUBLE CONSTITUENTS OF THE CRUDE OIL FROM DISTILLATE SEPARATORS CONDENSATE WATER OR TANK DRAWOFF
TANK BOTTOM SLUDGE
COKE FROM EQUIPMENT TUBES AND TOWERS
OIL AND ASPHALT FROM LEAKS AND TANK CLEANING
CONDENSER WATER
INTERMEDIATE STORAGE
FREE OIL FROM LEAKS AND OR TANK DRAWOFF
EMULSIFIED OIL FROM TANK DRAWOFF
TANK BOTTOM SLUDGE
SPECIAL CHEMICAL MANUFACTURING
CHEMICAL TREATMENT
DEWAXING WAX PROCESSING AND SIMILAR PROCESSES
ASPHALT MANUFACTURING
WASTE PLUMBITE SOLUTION FROM THE DOCTOR TREATMENT OF OILS
WASTE CHEMICAL SOLUTIONS FROM SPECIAL TREATMENT AND SELECTIVE SOLVENT REFINING
SPECIAL CHEMICALS FROM LEAKS AND WASTE PRODUCTS
FREE OIL FROM LEAKS AND SPILLS AND OILY WASTE WATERS
FREE AND EMULSIFIED OIL FROM LEAKS AND SWEATING OVENS
CONDENSER WATER
WAX TAILINGS
CHEMICAL TREATMENT WASTES
ACID SLUDGES, ACID WATERS, ALKALINE WATERS AND EMULSIONS FROM THE ACID TREATING NEUTRALIZING AND WASHING OF OILS
CAUSTIC SLUDGES WASTE CAUSTIC AND ALKALINE WATER FROM THE CAUSTIC TREATMENT OF OILS
SPECIAL CHEMICAL STORAGE
WASH ROOMS, RESTAURANTS, MECHANICAL SHOPS, POWER HOUSES, BARREL CLEANING, ETC.
FINISHED PRODUCT STORAGE
WAX PRODUCT STORAGE
ASPHALT PRODUCT STORAGE
SANITARY WASTES
GARBAGE
SPECIAL CHEMICALS FROM LEAKS AND SPILLS
SLUDGES FROM WATER TREATING AND BOILER BLOWDOWN
OIL FROM LABORATORIES, FLOOR WASHING, CUTTING TOOL EMULSIONS, BARREL WASHING EMULSIONS, ETC.
OIL FROM LEAKS AND SPILLS
ASPHALT FROM LEAKS AND SPILLS

Usually this is accomplished by recirculation in a closed system of which cooling towers are a part. In refineries in such sections there may be little, if any, uncontaminated cooling water waste. This may be true of refineries in other sections also, because of operation economics or for other reasons.

It is obvious, therefore, that there is little or no relationship between volume of crude run and the amount of uncontaminated water waste for the entire refining industry. This relationship is individual to each refinery. Also, as a consequence of once-through flow versus recirculation, there is no relationship between the volume of crude run and the total waste waters of any particular type of refinery. This also is individual to each refinery, and total waste waters may vary from perhaps 20 to 1000 gal per bbl of crude run.

Storm Water Waste

It may seem that storm water should not be included in the category of refinery waste. But at times it makes up a large part of the refinery waste waters. It often presents difficult surface water protection problems, and all operators who are responsible for waste treatment and disposal should have at least some knowledge of how storm water waste affects their waste treatment and disposal programs.

Storm water waste influences waste treatment and disposal by the volume and rate of "storm run-off." This can best be described as the storm water which neither is absorbed by the soil, nor retained temporarily by obstructions on the surface of the ground, nor is evaporated. There are fairly accurate records and probability figures on rainfall available [33, 34], but run-off can be estimated only on a basis of each individual refinery, for there are too many factors involved. Its careful estimation or measurement is very important however.

Oil and Oily Wastes, Including Emulsions

The best policy to follow in the practice of refinery waste treatment and disposal is one which assumes that *there is no such thing as waste oil;* that oil becomes waste only through carelessness, *unavoidable* accident, lack of foresight, or because of some particular process requirement. With the last reason given (i.e., process requirement), the amount of oil involved should be very small. Oil is too valuable to waste in any form, but experience in many refineries is that oil is one of the most universal wastes, and occurs over the entire refinery. In quality it ranges from the lightest products (e.g., gasoline) to the heaviest (e.g., heavy residual fuel oils and asphalts). It occurs in crude tank fields and around stills, in treating plants and in the finished products area. In quantity its occurrence shows some degree of uniformity, but with occasional wide variations. In the northern half of the country, where frost penetrates the ground, there is almost a spring and fall seasonal oil waste period as a result of pipe line failures due to ground conditions.

In years past, oil waste was so prominent a part of refinery wastes that many people had the idea that it was the only potential polluting material caused by refinery operation. That was during the period of flush crude oil production. Those days are gone, but waste oil still is with us to some extent and must be considered.

Waste oil occurs usually from leaks and spills, and to a minor extent from intentional discharge to sewers or drainage ditches. When the oil flows over the ground some penetrates the soil and some is evaporated. Depending upon the character of the oil (i.e., whether light or heavy) these losses can be relatively great. Some of the oil which penetrates the ground can be recovered at a cost, but that which evaporates not only is gone forever but in going, in vapor form, it creates a very serious fire hazard.

The oil which does not either penetrate the ground or evaporate, flows to some lower area which may be off the refinery property, or it may reach some nearby surface water, or it may flow to the refinery drainage system. In any case, it presents a problem. In the first two instances the problem usually concerns public relations, or some state or federal agency. When it flows to the refinery drainage system it mingles with other wastes and water, from which it must be separated before the refinery waste waters can be discharged or perhaps further treated. Thus an "oily water waste" is created, which sometimes is difficult and costly to correct.

Whenever oil and water come together there is the ever present danger of the formation of emulsion. All that is needed other than the oil and water is the proper emulsifying agent and agitation. Both will be encountered in the average refinery drainage system, and some emulsification of oily wastes usually results. Other emulsions occur as the result of refining processes. But before discussing emulsion wastes it is desirable to clear up the matter of the different types of emulsions. Experience shows that probably in no other problem of refinery waste disposal has more confusion resulted from the use of a generic term than with the term "emulsion." Emulsion has been defined variously [35, 36, 37] but the important matter in relation to refinery waste treatment and disposal is that there are two different general classes of emulsions, and that each class presents its own particular problems.

The first general class of emulsions may be designated the "water-in-oil" emulsions. There are two phases or parts to such an emulsion, a water phase and an oil phase. The oil phase is said to be *continuous*, and the water phase is said to be *dispersed* throughout the continuous oil phase in larger or smaller globules.

Since oil and water will not mix, and since the oil is the enclosing phase of water-in-oil emulsions, these emulsions will not mix with water wastes. Usually the emulsions occur in larger or smaller masses floating on the water of the waste stream. If examined carefully it will be found that the mass is surrounded by a septum, a thin skin-like structure which seems to hold the mass together through surface tension. The septum may extend in several directions through the mass, dividing it into what may be termed lobes. As the division of the emulsion increases, and the grain-like appearance indicates smaller and smaller lobes, or cells, the well-known "liver" emulsion results.

Further examination of water-in-oil emulsions will show that the confining septum or skin-like structure often is stabilized or strengthened by fine particles of solids such as coke, silt, spent clay, asphalt, or iron sulfide. When the septum is ruptured by agitation, or by actual puncture, practically clear water and free oil will separate so that, if the entire mass is broken up mechanically or the surface tension destroyed by heat or chemical treatment, the emulsion can be separated readily.

This type of emulsion is said to be only loosely bound, or unstable. It can be broken rather easily and, because it is preponderantly oil, the aggregate gravity of the mass usually is less than that of water. Thus the masses of emulsion will float, and can be retained and skimmed from the water surface. Because emulsions of this type are seen readily, are sometimes spectacular in appearance, and originate at so many points in the refinery, they have come to be thought of as the only important type of emulsion. They occur in sewer flows, in crude oil storage tank bottoms, and in some intermediate storage tanks. Other sources are the chemical treating plants, particularly those in which lubricating oils are processed, acid sludge hydrolyzing units, and sludge decomposition units.

Emulsions of this class exist with all proportions of oil to water, but usually there is much more oil. Rather superficial study of a series of such emulsions showed the average composition to be of the order of 80% oil, 18% water, 1.5% solids (coke and iron sulfide) and 0.5% unaccounted for.

The second general class of emulsions is the oil-in-water class, technically known as *hydrosols.* These emulsions also are in two parts, or phases. However, unlike the first class the oil is dispersed in minute globules throughout the water. In other words, the oil is in the dispersed phase and the water is in the continuous phase. Thus the water, being the surrounding medium, can mix with any other body of water and carry oil with it, so that the entire mixture becomes oil contaminated. This is what happens in the refinery when emulsions of this

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kind are allowed to enter the general drainage system. Although sometimes they encounter other wastes which break the emulsion, usually they pass on out through any gravity type separator and carry oil into the receiving surface waters and thus cause pollution.

Oil-in-water emulsions, as a rule, are relatively stable, i.e., they are not readily separated by mechanical or thermal treatment, or on standing. For example, a sample of such an emulsion was allowed to stand for over 5 years without any appreciable separation of oil or change in appearance. But when sufficiently diluted, as when discharged into a large body of surface water such as a river or lake, they do break, and the oil rises to form a film on the water surface causing decided and easily identified oil pollution. This is partly the result of electrical and other physical effects, and partly the result of hydrolysis of soaps which act as the emulsifying agent and may form part of the dispersed phase of the emulsion.

Oil-in-water emulsions occur at various points throughout the refinery. They are creamy white or milky in color, and as a result are known as "white-water," or "milk-water." They contribute this color to any water with which they mix and, depending upon the ratio of admixture (i.e., proportion of emulsion in the resulting mixture), tend to cause gradation of coloration ranging from that of milk down to simple opalescence. Therefore, any waste which is white or near white in color, or is opalescent in appearance, should be regarded with suspicion until it can be proven conclusively that it contains no emulsified oil.

Two important sources of oil-in-water emulsions are the chemical treating plants for both light and lubricating oils, and the hot-wells of barometric condensers. The discharges from steam-traps, when extended into sewers carrying oily wastes, to below or even just above the flow-level, give rise to such emulsions. Barrel washing plants are notable sources, particularly if barrels which have contained animal or vegetable oils are being washed. Even the condensate resulting from high-pressure steam washing of petroleum barrels, drums, or tanks, often is emulsified.

Not sufficient attention has been accorded emulsions of this kind. By many it has been concluded that, because the emulsified oil cannot be seen, none is there. This idea has been strengthened by the fact that free oil will float upon such emulsions in the same manner as it will float on water. But if some of these emulsions are broken, or ether extracted after acidification, up to 30,000 parts per million of oil, or sometimes more, will be found. Fig. 2 illustrates just how seriously these emulsions can contaminate an otherwise relatively oil-free refinery waste water. No attempt has been made to include here a technical discussion of emulsions such as will be necessary to some extent later. (See 37, 38, 39).

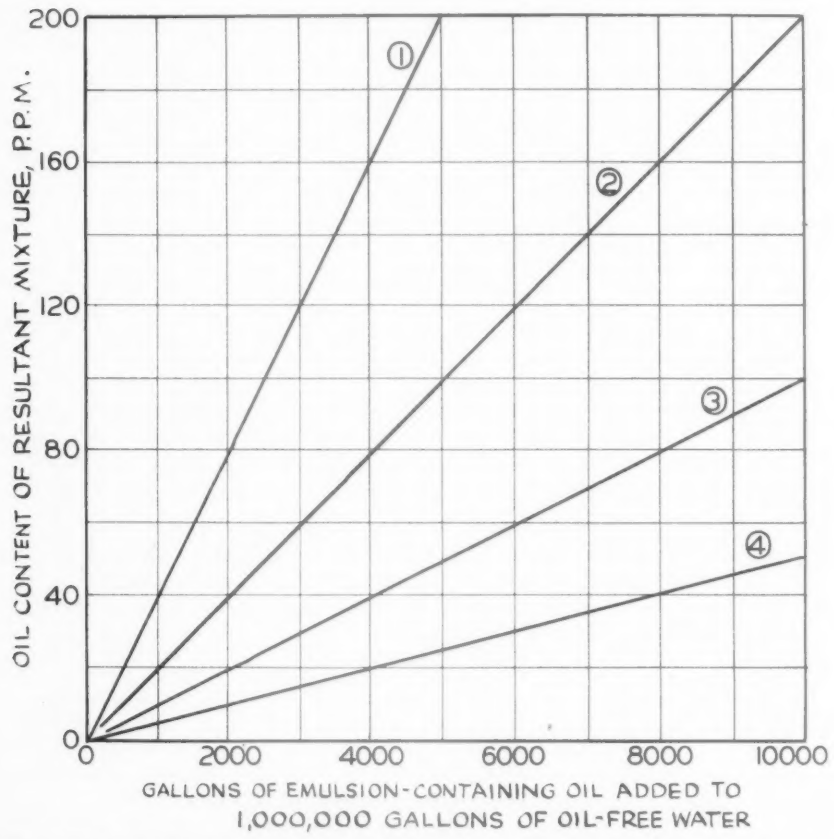

Fig. 2—Effect of addition of stable emulsions (oil-in-water) on oil-free water. The oil content of the various emulsions is as follows: curve 1—40,000 ppm, curve 2—20,000 ppm, curve 3—10,000 ppm, curve 4—5000 ppm

Wastes which Affect Hydrogen-Ion Concentration, Acidity, and Alkalinity

Substances which occur in petroleum refinery wastes, and which affect hydrogen-ion concentration (usually designated as pH), sometimes are believed to be only the strong acids and alkalies. This is not entirely true. Although acids and alkalies have pronounced effects upon hydrogen ion concentration, certain dissolved mineral compounds (dissolved solids) modify, or buffer the effects of acids and alkalies so that these effects are not so pronounced. Dissolved solids of this kind originate at various points in the refinery, principally in the chemical treating plants, boiler water treating plants, catalytic cracking units, and in various special products plants. Not infrequently these substances result from reactions which are a part of the refining or treating process. Such compounds also are present in most refinery water supplies.

Buffer compounds generally are weak acids or bases which ionize only little. In solution the ionized portion and un-ionized portion are in balance. When strong acids or alkalies (which are highly ionizable) are introduced into the solution they are neutralized by the ionized portion of the buffer compounds. Then, to re-establish the balance, more of the un-ionized buffer compounds ionize and resist any change in pH by neutralizing more of the strong acid or alkali. This process continues until the capacity of the buffer compounds is exhausted, i.e., until all the buffer compounds have become ionized and have reacted.

In refinery wastes, carbon dioxide, carbonates and bicarbonates, phosphoric acid and phosphates, sulfur dioxide and sulfites, and sodium sulfide are among the more prominent buffer compounds. Calcium carbonate and iron sulfide, although they are suspended in the waste flow, act like buffer compounds to acidity.

As has been stated above, acids have pronounced effect on pH, and acidulous aqueous wastes are among the important wastes of many petroleum refineries. They originate principally in the treating plants, acid recovery areas, alkylation units, some water treating plants, and in some special product operations. They result from the washing of intermediate petroleum products, both light oils and lubricants which have been acid treated, and from leakage and spills around these plants. Acid recovery units of various kinds also are the origin of acid wastes. Spills and leakage are the usual direct cause, but careless handling of

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acid sludges, such as storage where rains or run-off water can leach out the acid in the sludges, also contribute. Some acidulous waters which result from hydrolysis of acid sludges also are discharged as wastes because concentration for reuse is uneconomical.

Some processes discharge small quantities of dilute acids as a normal process procedure. Sludge conversion units, for example, produce a small quantity of dilute acid from the Cottrell precipitator which is a part of the train of equipment used to purify the sulfur dioxide prior to conversion. Hydrofluoric acid is discharged from the recovery section of hydrofluoric acid alkylation units. Sulfuric acid escapes from valves, lines, and pumps around sulfuric acid alkylation units.

Sulfuric acid is the usual basis of the acidity in petroleum refinery wastes. Hydrofluoric acid is discharged by some refineries. But there are other kinds of acidity which though relatively unimportant must be considered. For example, water which has been used to scrub sulfur dioxide streams in sludge conversion units, and which is not recirculated, contains sulfur dioxide in quantity sufficient to cause relatively high acidity. Water used to scrub refinery gases for removal of hydrogen sulfide is acid as a result of this compound in solution, or this gas may result from interaction of mineral acid and soluble sulfides in the drainage system.

Phosphoric acid is used as a catalyst in several refinery processes. It is carried by various forms of clay, e.g., pellets, the clay being impregnated with the acid. From time to time the catalyst must be replaced, and the catalyst removed from the unit must be disposed of. Although the clay is relatively harmless, the phosphoric acid may leach from it and contribute a form of acidity in refinery wastes which may require consideration.

Aluminum chloride is used in a manner similar to phosphoric acid in catalysts for other purposes. This substance is used in the anhydrous form in some catalysts for isomerization reactions. When it contacts water it reacts to form hydrochloric acid and may cause hydrochloric acid acidity in refinery wastes.

Carbon dioxide is a form of acidity not often considered in connection with refinery wastes, but it can assume importance at times. Carbon dioxide can result from the interaction of mineral acids with carbonates such as the wastes from boiler water treating plants, discarded soda-ash solutions, and similar substances, in the refinery drainage system. It may be discharged in solution when water seals or tanks of gas-holders used to hold carbon dioxide (to be used as an inert gas for fire and explosion protection) are overflowed or drained.

Alkalies influence hydrogen-ion concentration in a manner which may be regarded as opposite to the influence of acids. They occur in the wastes of treating plants where alkaline washes are used for acid neutralization. The waste caustic from the removal of hydrogen sulfide, and so forth, will be discussed later. The water wastes separated from distillates from stills in which anti-corrosive agents are used sometimes are highly alkaline.

The alkalinity in refinery wastes is due usually to sodium hydroxide, sodium carbonate, or ammonium hydroxide. Lime sometimes contributes to alkalinity when it is carried into the refinery drainage system. As may be concluded, alkalinity in refinery wastes usually is not so important as acidity, but it can be under certain specific conditions.

Wastes Which Absorb Dissolved Oxygen

Refinery wastes which absorb dissolved oxygen, i.e., have an oxygen demand, are among the most important to be considered. It is at this point that the first important overlap of waste characteristics, as mentioned above, is encountered. Probably the most serious refinery waste, from the standpoint of oxygen absorption, is the waste caustic discharged from units in which hydrogen sulfide, mercaptans, and so forth are removed from crude oils, or from light, straight-run or cracked naphthas. This waste also is highly toxic, usually is highly colored, and is principally noted as the cause of taste and odors, in which class of wastes it usually is included. As a matter of convenience in presentation, when characteristics overlap in this manner, only the characteristic which falls in the class under discussion will be considered.

Waste caustic, sometimes called caustic sludge, varies greatly in appearance and composition, depending upon the crude being run, or the light oils being washed. It the crude is a "sweet" crude, of paraffinic base, and is simply to be topped, the waste caustic may be without color of any intensity, for it will result from washing the light distillate only, and not the crude, and may be used only to remove still odor and minor undesirable constituents. Its components of importance are principally the unused caustic soda and minor sulfur compounds which result in an oxygen demand as low as 50 parts per million.

Waste caustic which results from washing crudes high in sulfur compounds, and of mixed paraffinic and naphthenic, or practically entirely naphthenic base, usually is of a deep reddish brown color, but may be blue or green, and usually is turbid. It contains about 0.3% residual caustic soda, but it also contains sodium sulfide, sulfate, sulfite, thiosulfate, and other complex oxysulfur compounds, phenol and phenol-like compounds, mercaptids, naphthenates, and various other organics. Every intergradation between these two types of waste caustic occur in different refineries.

Practically all of the waste caustic components mentioned above, with the exception of caustic soda and sodium sulfate, will absorb dissolved oxygen either through chemical or biochemical action. Some of the most serious waste caustics have a five-day biochemical oxygen demand as high as 200,000 parts per million. Much of the five-day demand is chemical, and takes up oxygen rapidly. Fortunately, these wastes occur in only relatively small quantities.

Other refinery wastes have an oxygen demand. Waste from various refinery gas washing units contains chemicals such as hydrogen sulfide, phenol, nitrogen compounds, and various other substances which will take up dissolved oxygen. So-called soaps, which in reality are salts of sulfonic and other similar organic acids, and which occur in the wash waters from acid treated products, both light and heavy, are of high oxygen demand. Naphthenates and sulfonates in acid sludges, when leached with water, fall into the same category. Solutions, suspensions, or emulsions of these substances are among the most serious oxygen consumers.

Water which settles from crude oil in storage, and from some intermediate products, contains various substances, largely unidentified, which absorb dissolved oxygen rapidly. Water which separates from distillate separators, on both primary distillation and cracking units, carry similar products.

In some refineries extensive barrel-washing operations are carried on, and used barrels which have contained animal or vegetable oils are washed. The waste wash water usually is a milky emulsion containing the oils from the barrels. This waste usually is very high in oxygen demand. Wastes from grease plants and special lubricants manufacture are similar in nature. The oxygen demand of these wastes, like that of the sanitary sewage of the refinery, is practically entirely a biochemical demand.

Wastes Which Cause Tastes and Odors

The phrase "taste and odor" has been adopted from the language of water purification technology. In water purification plants, where water is purified for domestic consumption, the water is both tasted and smelled during the course of testing. But under no circumstances should any refinery waste ever be tasted until there is complete assurance, by every reasonable test, that all harmful or toxic characteristics have been eliminated. In the case of wastes, odor only has been considered. This has resulted to some extent, also, from the fact that it is so difficult to distinguish between taste and odor nerve reactions. This is briefly but clearly discussed by Heilbrunn [40].

The outstanding taste and odor pro-

ducing wastes from petroleum refining are the waste caustic solutions which are discarded after washing crude oils, or light distillates from either straight-run or cracking process distillation. These waste caustics vary widely in characteristics.

Waste caustic from washing light distillate cuts of sweet, low sulfur crudes may have but little odor, and that odor present often is not persistent. This may be expressed by saying that it has a low threshold zone, which is that dilution ratio with odor-free water at which the odor characteristic of the waste just is perceptible. Numerically the threshold zone may be as low as one part of waste in 100 parts of a mixture with odor-free water.

Waste caustics which result from washing high sulfur crude, or cracked distillate from high sulfur stocks, may have threshold zones as high as one part in 50,000,000 parts or more. Their odor in large part is due to complex organic sulfur compounds, alkyl disulfides, complex nitrogen compounds and other substances the identity of which has not been established too clearly. Naphthenates of various compositions usually form a considerable part of the waste. Phenol, and phenol-like substances contribute to the odor and to other characteristics. The composition of waste caustics will be considered in some detail in connection with methods for its treatment and disposal.

Acid sludges probably are the next most important waste in the class of those causing taste and odor. Sludges which result from the acid treating of light distillates have much more pronounced odor than those which result from the treating of lubricating stocks. Much of the odor from light oil sludges is due to mercaptans.

The odor of mercaptans is extremely disagreeable. It has been described as garlic-like or onion-like but is much more persistent. It has been claimed that one part of ethyl mercaptan (C_2H_5-SH) is detectable in 50,000,000,000 parts of odor-free water. Heilbrunn (40, p. 614) records the recognition of one of the mercaptans in concentration of 1:23,000,000,000 mg. per ml.

Careless handling of these sludges which permits their drainage, or the sludges themselves, to enter the general refinery drainage system creates a most serious waste treatment and disposal problem.

A waste of pronounced odor, but fortunately of relatively small quantity, is the drainage or "drips" from refinery gas lines. Various sulfur compounds, organic in nature, as well as nitrogen compounds and mercaptans are the cause. Although this waste usually is of small volume over the plant, it is sufficiently offensive to create really serious problems. Solutions used for the removal of hydrogen sulfide, when spent and discharged, become a waste which at times is almost as serious as the gas drips.

Water which has contacted gasoline, and to some extent lubricating and heavier stocks, retains odor. This odor, although pronounced, particularly when the water has been in contact with gasoline, is not persistent and dissipates fairly rapidly when the water is exposed to aeration or agitation.

Toxic Wastes

Toxicity in connection with waste treatment and disposal usually is understood to mean toxicity to aquatic life, i.e., the plant and animal forms, both small and large, which inhabit the surface waters into which the waste may be discharged. However, toxicity in this degree serves as a criterion of the overall toxicity of the waste.

Several wastes which have been included in previously discussed classes are among the toxic wastes of petroleum refineries so there is need here to refer to them only briefly.

One of the most toxic wastes is the already mentioned waste caustics. The complex sulfides, naphthenates, and mercaptans in this waste all are poisonous. The high concentration of dissolved mineral matter is lethal as a result of osmotic effects, which although not true toxicity, is destructive to aquatic life. The oxygen demand of this waste, because it removes the dissolved oxygen from the surface waters, often is fatal to aquatic life.

Drainage from acid sludges, usually because of mercaptans and nitrogen compounds as well as the actual acidity, is a highly toxic waste.

Ammonium salts, sulfides and polysulfides, resulting as waste from the use of ammonia as an anticorrosive agent, are among the substances most toxic to aquatic life.

The water which settles out of some crude oils while in storage has been shown to be highly toxic.

In some refineries special organic chemicals such as alcohols and special solvents are manufactured. The wastes from these processes as well as the products themselves are highly toxic.

Wastes Which Are Highly Concentrated Solutions of Mineral Matter

Here again a previously mentioned waste, i.e., waste caustic, probably is the most important. The sulfide, sulfate, and thiosulfate components are present in concentrations which are important because of their several effects.

Another waste which falls into this category is that resulting from the caustic washing of acid treated products. This wash usually follows a water wash which is applied to remove most of the acid. But enough acid remains so that when neutralized it results in a relatively concentrated solution of sodium sulfate.

Some crude oils when brought to the

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refinery carry with them mechanically held, or partly in loosely bound emulsions, considerable quantities of brine which comes from the well with the crude oil. The salt water settles out in the storage tanks and from time to time is drawn off to the drainage system. Thus it becomes a waste which is a highly concentrated solution of chemicals, mostly sodium chloride. The concentration at times is as high as 50,000 parts per million and may reach a maximum of 250,000 parts per million[41, 42, 43].

Crude oils of this character not infrequently are subjected to de-salting processes prior to further refining. The waste from this operation also is a concentrated solution of chemicals.

Wastes Which Carry Suspended Solids and Are Turbid

The term "suspended solids" as used here describes the great variety of insoluble substances which are carried along in the plant drainage flow, but which will settle whenever the velocity of the flow is reduced for any considerable time, as in a separator. In refinery wastes suspended solids take various forms from finely divided sand, clay, coke, or lead sulfide, to floc-like particles which often are metallic oxides and hydroxides or various insoluble organics.

Reactions take place between wastes from different operations when they mingle in the plant drainage system causing precipitates which form some of the flocs mentioned. Some of the organics are waxes of various characteristics. Still others are insoluble esters, and some are biological growths, often thought to be algae.

Turbidity also is caused by both inorganic and organic particles. When clay, coke, sand, cinders, lead sulfide, iron sulfide, and so forth, are so finely divided that they will not settle in a reasonable time under quiescent conditions, a condition of turbidity exists. Finely divided organic substances of different kinds also cause turbidity, and one of the principal causes in refinery wastes is white water, or milk water which, as previously explained, is an oil-in-water emulsion.

Wastes which carry suspended matter, and are turbid, may enter the refinery drainage system from various operations. Pipe stills running crudes which require the use of ammonia as an anti-corrosion agent often discharge polysulfides. When the polysulfides encounter acidulous waters the acidity reacts with the polysulfides and finely divided sulfur is thrown out of solution to create turbidity. Waste caustic wash waters from chemical treating plants precipitate iron dissolved by corrosive action. Waste "doctor solutions" often carry suspended lead sulfide, and the hydroxide residual in this waste precipitates metallic hydroxides and oxides which have been in solution in the waste flow.

Waste from contact clay plants is a frequent cause of the turbidity. Burned clay, which by handling or crushing has become finely divided, also is a frequent cause of turbid waste from clay filter plants. Solids from boiler water treating plants and from boiler blow-down are contributors.

Storm water carries clay, cinders, and so forth from bare areas of the refinery into the drainage system, and in some regions the plant water supply is heavily loaded with silt before it even enters the plant. High calcium and magnesium in water supplies, when precipitated by sulfate ions or carbon dioxide, also are causes of turbid waste.

Colored Wastes

About the only colored waste resulting from refinery operation is waste caustic, which although it usually ranges in color from yellowish through red to deep reddish brown, may be green or even blue. Minor quantities of other colored wastes occur, not infrequently the result of dyes used in various products. Black water, usually acidulous, and occurring as a phase of acid sludge separation, or as drainage from acid sludge, occurs as a waste from the sludge handling and acid recovery section of the refinery.

Minor Miscellaneous Wastes

There are numerous minor miscellaneous wastes which each or severally are peculiar to different refineries. Often these are wastes from experimental units. Various highly complex organic compounds used as stabilizers for gasolines in storage, film strengtheners and viscosity additives for lubricants, and for other purposes, escape from time to time or are discarded, creating waste treating and disposal problems. Various solutions such as ethanolamines, phenolates, and so forth, which are discarded relatively infrequently, create similar problems. Wastes of this classification are too numerous to enumerate.

Semi-Solid and Solid Wastes

Among the important semi-solid and solid wastes usual to petroleum refineries are acid sludges, spent clay, fine clay slurries, spent catalysts, tank bottoms, separator cleanings, and, in some plants, spent doctor slurries. Under some circumstances, none of these are regarded as wastes, but are raw materials for recovery processes.

The enumeration of petroleum refinery wastes which has been presented briefly above does not pretend to include every individual waste which occurs in every refinery. It has for its purpose the presentation of the major wastes and the various classes of wastes. Thus there can be better understanding of the considerable number of wastes which may affect adversely the surface waters into which they may be discharged. The manner in which surface waters are affected is one of the most important phases of a comprehensive understanding of waste treatment and disposal. It is proposed to discuss these effects in some detail in following articles.

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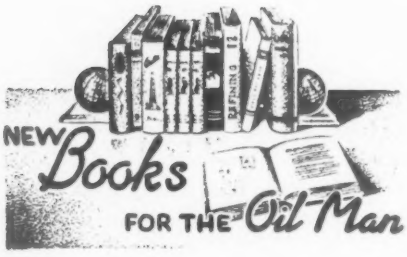

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The latest authoritative text on standard methods of testing and analysis of gaseous materials, covering the entire field, is *Gas Analysis and Testing of Gaseous Materials*, by V. J. Altieri, chief chemist Eastern Gas & Fuel Associates, Boston. It represents a revision of the gas analysis chapter in the 1929 edition of "Gas Chemists' Handbook" by the American Gas Assn., and was written under the direction of the association's handbook revision committee.

The present work is designed to furnish a comprehensive book of standards for sampling, analyzing and testing of gases and gas mixtures containing varying amounts of liquid and solid dispersoids; to correlate information widely scattered throughout the technical literature together with unpublished information thoroughly proved by contemporary workers or personal experience; to direct attention to important details of safety and accident prevention and to correlate information for instant availability to chemists, physicists, engineers, laboratory technicians, operators and others.

There are 20 chapters, an appendix, lists of illustrations, tables and bibliography, and name and subject indexes. The appendix contains valuable technical material, much of it in tabular or graphical form, pertaining largely to physical constants data, properties of gases and various correction and conversion factors.

Explains Instruments, Process Control in Simple Language

Instruments and Process Control, a monograph by R. E. Clarridge, J. S. Detwiler, G. E. Heller, R. N. Pond and B. C. Delahooke; 8½ x 11 in., 233 pages, paper cover, plastic bound, indexed and illustrated, $2.75.

Instruments and Process Control is a monograph prepared in the Curriculum Laboratory at Cornell University, in cooperation with the Taylor Instrument Cos. Unlike most texts on instrumentation which we've read in the past, this one is in language that doesn't require the reader to be an instrument expert in order to understand it. The material is developed in an orderly manner, with the technical words and terms peculiar to instruments being explained when they are first used.

The meaning of an industrial process and why its variables should be measured and controlled are dealt with first. Following that, definitions are given of the more common instrument terminology.

Copies of all books reviewed on this page can be ordered from the Book Department of *National Petroleum News*, 1213 West Third St., Cleveland, 13, for the prices listed, postpaid. Ohio purchasers please add 3% tax.

Later chapters discuss basic control theory, simple controllers, and controller mechanisms. Nearly half the book is devoted to applications of controllers.

Authors Ralph E. Clarridge, J. S. Detwiler, George E. Heller, and Richard N. Pond are with the Taylor Instrument Cos., and B. Chester Delahooke is with the Cornell Curriculum Laboratory.

Although *Instruments and Process Control* is reproduced from original typewritten pages (by multilith or some similar printing process) it is well prepared and easy to read. Illustrations, both photographs and drawings, are used extensively—over 200 of them. Any refinery engineer interested in instrumentation and process control will find this text a valuable adjunct to his library.

British Petroleum Tables Published by Institute

Tables for Measurement of Oils, by Measurement and Sampling Subcommittee of the Institute of Petroleum (British); 6 x 9 in., 320 pages, stiff cloth binding, 25 shillings (British currency, about $5.00 U. S. currency), published by Institute of Petroleum, Manson House, 26 Portland Pl., London, W. 1, England.

The official British counterpart to the Bureau of Standards' Circular C-410, "National Standard Petroleum Oil Tables," has been completed by the Measurement and Sampling Subcommittee of the Institute of Petroleum—*Tables for Measurement of Oil*. It fills a long-felt need for authoritative tables for use in computing oil quantities in territories which employ the British system of weights and measures.

In the new book, the main tables contained in Circular C-410 have been recalculated to permit entry with specific gravity instead of API gravity, and supplemented by additional tables giving weights per unit volume and volumes per unit weight. In case of the latter tables, data which are legally recognized or which research has shown to be most accurate have been employed in the computations.

Each of the 16 tables is preceded by its own introductory notes showing why the table is necessary and giving examples of correct use, a valuable and time-saving procedure. Particular attention was paid to style of type and format as well as ease of reference in constructing the tables.

In the introductory notes to a table for interconversion of weights in air and weights in vacuo, it is pointed out that both British and American systems legally require weights to be in air. Tables allow calculations of weights in air direct from specific gravity determinations.

However, in many countries using the metric system it is common practice to calculate weights in vacuo directly from densities and metric volumes, therefore a special table is included to take care of this change in basis. Similar tables, it is stated, were submitted to the American Society for Testing Materials and have been approved and published "for information."

In compiling the book, credit is given to U. S. Bureau of Standards, American Petroleum Institute, American Society for Testing Materials and Natural Gasoline Assn. of America for their cooperation and assistance.

Stress-Corrosion Cracking Of Metals Is Reviewed

Symposium on Stress-Corrosion Cracking of Metals. Paper and discussions at joint meeting of American Society for Testing Materials and Institute of Metals Division, American Institute of Mining and Metallurgical Engineers: 9¼ x 6¼ in., 493 pages, stiff cloth binding, illustrated, $5 to members, $7.50 non-members. Order copies directly from either society.

Only a few brief references to applications in petroleum refining are found in this report of a three-day joint session of the societies named above. The whole field of stress-corrosion was covered to bring together present-day knowledge and recently determined data on the failure of metals and alloys under conditions of combined stress and corrosion.

Papers cover theory of stress-corrosion cracking, test methods, failure of brass and other copper-base alloys, testing and susceptibility to failure of the light alloys, stainless steels, galvanized steel, bridge wire, nickel and nickel alloys, lead alloys and other metals. The material was edited by Carter S. Cole of the A.S.T.M. staff.

Helpful Trade Literature

A Study of Costs — The Economics of Postwar Motor Gasoline Refining: Booklet of 5 economic studies of typical American refineries processing different crudes with varying equipment illustrate advantages of new improved processes. Included are operating costs, amortization of new equipment, suggested flow diagrams. Each of the studies is a self-contained removable unit: M. W. Kellogg Co., 225 Broadway, New York.

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Simplicity and Flexibility of TCC Process Fits it for Small-Scale Operations

By H. D. Noll, E. V. Bergstrom and K. G. Holdom

Thermofor catalytic cracking is shown profitable when used with thermal cracking in relatively small-scale operations. Investments and yields are presented for a plant running 5000 b/cd of typical Mid-Continent crude, with topping, two-coil thermal cracking and naphtha reforming; processing in a moderate recycle operation in an added TCC unit the material formerly going to thermal cracking. Additional yields of higher octane gasoline result with decreases in yield of heavy fuel oil and fuel gas.

Mechanical improvements have made the TCC process adaptable particularly for small-scale operations and have reduced the cost below that of scaled-down versions of conventional early design. These improvements include among others combining in one vessel the reactor, hot catalyst storage drum and reactor feed hopper, and the use of a single elevator in place of two elevators.

A SMALL scale integral Thermofor Catalytic Cracking unit has been developed by engineers of Houdry Process Corp. and Socony Vacuum Oil Co., Inc. The unit can be designed to process from 1000 bpsd upward of virgin charging stocks ranging from heavy naphthas to vacuum distillates. Its simplicity of design and flexibility of operation make catalytic cracking feasible and practical for operators of smaller refineries. The unit is characterized by high yields of high quality product at high liquid recoveries with low investment cost and low operating and maintenance costs. The integral design and simplicity of construction details make for a high percentage of on-stream time.

One outstanding and generally recognized feature of the TCC process is the high yield of useful products per unit of feed disappearance and per unit of catalyst deposit. Liquid recoveries (gasoline plus butanes plus cycle gas oil) range from 97 to well over 100% depending upon the character of the charging stock and the conversion employed. These high liquid recoveries are obtained by operating at conditions where catalytic action can be maintained at a maximum and deleterious thermal side reactions kept to a minimum. These operating conditions require the maintenance of relatively high catalyst activity and, for very high conversions, recycling of catalytic gas oil.

As a result of careful control of regeneration conditions the catalyst activity in TCC units is maintained at a high level. The Thermofor kiln regenerates in stages or zones each having its own air and coolant control. The portion of the catalyst deposit containing high concentrations of material other than pure carbon is removed in the initial stages at low temperature conditions (875-975° F). Thus, water vapor and oxides of impurities such as sulphur are removed from the regeneration process before any high temperature combustion occurs. It then becomes possible to reactivate the catalyst fully by burning off carbon to a very low residual concentration on catalyst without incurring losses in activity from high temperature contact with steam or sulphur compounds. This stage burning allows high catalyst activity maintenance with relatively low catalyst replacement rates. Performance on commercial units throughout the war program has demonstrated the practicability of maintaining activities of 30-31 Activity Index for clay with 0.5-0.6 lbs/bbl. make-up and 34-36 A. I. for synthetic catalyst with 0.15 to 0.27 lbs/bbl. make-up.

Table 1 has been prepared from correlations to illustrate the effect of catalyst activity on gasoline yield, liquid recovery and coke production at constant gas oil disappearance.

It will be noted that with the lower catalyst activity the coke plus dry gas yield has increased by 1.2% while the gasoline yield and liquid recovery have decreased by 2.4% and 1.7% respectively.

In many instances and especially in the case of installation in smaller refineries recycle Thermofor catalytic cracking is particularly attractive. Only moderate recycle ratios are required to produce gasoline yields far beyond the reach of thermal processing methods. The quality of such gasoline is as good or better than that produced by single-pass operation and the increase in investment cost is minor in relation to the substantial gasoline yield increase. In many cases this type of operation can be readily fitted into existing thermal cracking equipment at a considerable saving in investment cost. Table 2 shows yields for single-pass operation and for recycling at 0.5/1 and 1.0/1.0 (recycle/fresh feed) ratios on a typical Mid-Continent wide cut gas oil using 30 A. I. clay catalyst.

Mechanical Features

The main components of the catalytic section of a TCC unit consist of the reactor where oil vapors are contacted with hot catalyst, the kiln where the resulting carbonaceous deposit is burned off and the catalyst regenerated, and bucket elevators to transfer catalyst from the bottom of the kiln to the top of the reactor and from the bottom of the reactor to the top of the kiln. Auxiliary equipment includes a compressor to supply inert gases for sealing the top of the reactor from atmosphere, an air blower and line burner for supplying combustion air to the kiln, and a steam generating system in which water is pumped through the kiln cooling coils after which the steam generated is disengaged in a flash drum; an elutriator, the purpose of which is to control the particle size of the catalyst being circulated; a fresh catalyst make-up hopper and facilities for supplying fresh catalyst to the hopper, and a fines storage bin. This equipment is all of simple and rugged construction. Fig. 1 is a simplified flow diagram of the catalytic section of a TCC installation.

A characteristic feature of the catalyst

This paper was presented before the Western Petroleum Refiners Assn., Fort Worth, March 27, 1946, under the title "Simplicity and Flexibility of Thermofor Catalytic Cracking." The complete text of the paper is published here but some of the illustrations have been omited.

H. D. Noll and K. G. Holdom are with Houdry Process Corp.; E. V. Bergstrom is with Socony-Vacuum Oil Co., Inc.

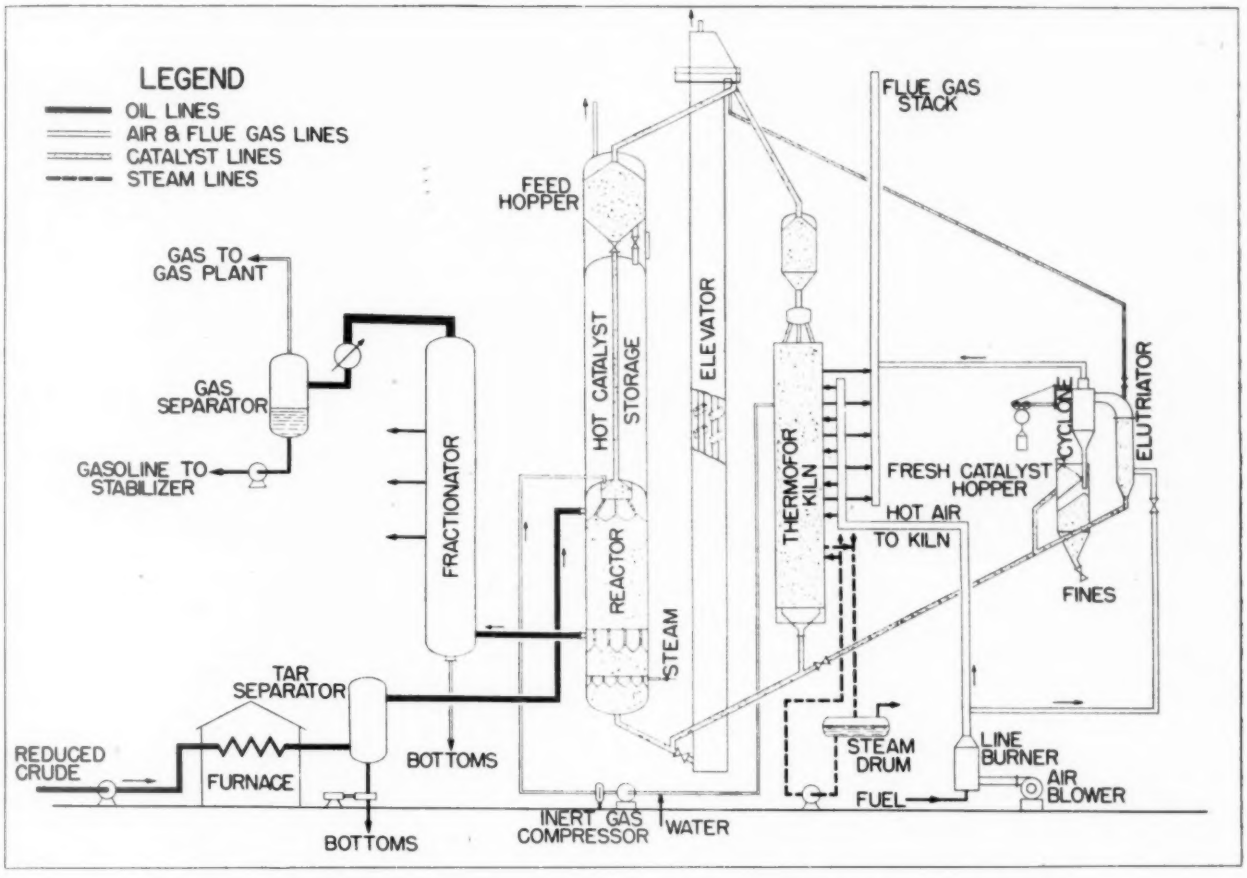

Fig. 1—Simplified flow diagram for the catalytic section of a typical TCC installation

flow in a TCC unit is the low catalyst velocities required to circulate the relatively low tonnage of catalyst per hour. The vertical downward velocity of the catalyst in the kiln and reactor is of the order of 6 in. to 12 in. per minute. The velocities in the catalyst carrying lines are in the range of 1 ft to 2 ft per second. No erosion has been encountered in plants of the latest design. In the kilns of early installations, some erosion of the refractory kiln lining was experienced. This was corrected by application of hard face refractory coatings and on later intallations by the use of suspended refractory brick walls. Inspection indicates that kiln linings of the latter type will have an indefinite life.

Erosion Problem Eliminated

No erosion whatever has been experienced in vertical catalyst pipes, but on sloping lines the bottom of the pipe as originally designed eroded out quite rapidly. This erosion was completely eliminated by installing small vertical baffles at intervals in the bottoms of the lines so that a layer of stagnant catalyst remained in the bottom of the pipe and the moving catalyst flowed over this stationary catalyst instead of over the bottom of the pipe. Largely because of the extremely low catalyst velocities employed, erosion in TCC units proved to be a simple and easily corrected problem and may be considered at the present time to be completely eliminated.

Catalyst is supplied to the reactor through a vertical pipe approximately 50 ft. in height depending upon the pressure to be maintained within the reactor. This pipe called the seal leg has a hopper at the top end into which the elevator discharges. This hopper is maintained full of catalyst so that the seal leg also remains full of catalyst at all times. It is therefore possible to operate the reactor at a pressure as high as 15 psi. with the upper end of the seal leg open to atmosphere with catalyst flowing downward through the seal leg against the higher pressure below and without discharging oil vapor to atmosphere, by virtue of the effect of the dead weight of the column of descending catalyst together with the fact that sealing gas flows upward through the catalyst instead of oil vapor.

This is done by injecting at the lower end of the seal leg a stream of inert gas a small part of which descends into the reactor and emerges with the product oil vapors, and the balance flowing up the seal leg at a rate sufficient to cause a pressure drop equivalent to the pressure differential between the top of the reactor and atmosphere. The seal leg has proved an extremely simple and foolproof means for introducing catalyst from atmospheric pressure into the higher pressure of the reactor. There is no possibility of blowing a charge of catalyst from the reactor with this arrangement.

The kiln operates under a pressure not

TABLE 1—Effect of Catalyst Activity on Gasoline Yield, Liquid Recovery and Coke Production

Catalyst Activity Index	28	32
Conversion, Vol. %	60.0	60.0
Temperature, °F.	860	860
Gasoline, Vol. %	46.0	48.4
Liquid Recovery, Vol. %	99.2	100.9
Coke, Wt. %	4.0	3.6
Dry Gas, Wt. %	7.6	6.8

TABLE 2—Yields for Single-Pass and for Recycling on Mid-Continent Gas Oil

Recycle/Fresh feed ratio	0/1	0.5/1.0	1.0/1.0
Debutanized Motor Gasoline, Vol. %	42.0	56.0	64.8
Total B-B, Vol. %	10.0	12.8	15.3
Cycle Gas Oil, Vol. %	46.0	28.0	15.0
Dry Gas, Wt. %	6.5	8.0	9.6

more than one psi. above atmospheric and usually less and is therefore an inherently safe piece of equipment. The bucket elevators are vented to atmosphere. These atmospheric vents provide a positive separation of the kiln and the reactor and reliance need not be placed on differential pressure valves or such devices to insure that hydrocarbon vapors from the reactor will not enter the combustion zone of the catalytic unit.

When the first TCC unit was built there was some question as to whether bucket elevators would give continuous service at the high temperatures and loads to which they would be subjected. A 500 bpd pilot plant had been built and operated for a year using a common commercial type bucket elevator and water cooling the head shafts. Only minor troubles were encountered with the malleable iron chain links in this equipment. The TCC elevators now manufactured by the Jeffry Elevator Co. have been designed for high temperature operation utilizing the best materials and metallurgical knowledge available. Consequently, even the first units built anticipate a satisfactory chain life of 18 months to 2 years.

In the early installations the top chain sprocket teeth wore quite rapidly due to uneven application of hard surface material during manufacture. In spite of this it has been possible to obtain from a set of sprockets a life of 12 months or more by simply reversing the teeth. The most recent elevator improvement has been complete elimination of sprockets, substituting a traction drive between the chain and traction wheels. In this manner wear has been distributed around the periphery of the traction rim instead of being concentrated locally at the sprocket teeth and latest wear measurements indicate the anticipated life to be 5 to 10 years for a set of traction rims.

Elevator circulating capacities used have been 100 tons/hour and 150 tons/hour with chain speeds in the range of 90 to 125 feet/minute. At this circulating rate and speed, the power required to circulate catalyst is about 60-80 hp. No shutdown due to failure of elevator chain or sprockets has ever been necessary on any of the TCC units built to date.

Catalyst Flow Is Uniform

An important feature of the flow of catalyst in the TCC unit is the uniformity of flow on the cross section in the kiln and the reactor. This is absolutely necessary if uniform reaction conditions are to be maintained in the reactor and uniform carbon combustion conditions maintained in the kiln. This uniformity of flow in a catalyst bed of large area is accomplished by a system of drawoff baffles at the bottom of the reactor and the kiln. This catalyst flow control system was developed by Socony-Vacuum research engineers with the aid of full-scale models and is one of the basic features of the TCC technique. (Fig. 2).

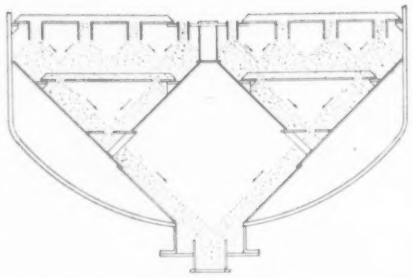

Fig. 2—Typical TCC reactor draw-off baffles

The catalyst flow rate through the kiln and the reactor is controlled by valves in the feed lines to the elevators. The latest type of valve provides close control of the catalyst flow rate and is of very simple rugged construction. In other locations for shut-off purposes, plug valves are used where some pressure is to be held. Elsewhere just a simple slide plate between flanges is used. The catalyst level in the top of the feed hopper above the reactor is determined by a level indicator which on some units is connected with the catalyst flow control valve in the feed line to the elevator in such a way that automatic level control is obtained. The importance of this interconnection is, however, questionable as feed hopper level stability is easily maintained with only minor adjustments at infrequent intervals at catalyst flow valves. When the levels in the hoppers become low make-up catalyst is added. It enters the system from a catalyst make-up hopper which drains into the feed line to one of the elevators.

With its low circulating rates and catalyst velocities, and its relatively small forces and power required in circulation of catalyst, the TCC unit utilizes a catalyst moving system which is inherently both safe and simple.

TCC reactors up to the present time have been operated with hydrocarbon vapors flowing countercurrently to the descending flow of catalyst, but the flow in this respect may be either countercurrent or concurrent and the choice is a matter of operating conditions desired in any particular plant.

In either system the catalyst bed remains a solid bed with the vapor flowing between the catalyst particles which remain in contact with each other and not in agitation in any manner. As a result hydrocarbon vapors are easily disengaged from the catalyst and only a small amount of dust (100-200 lbs./day) is carried into the fractionating tower where it is usually withdrawn with a simple settling pot from which dust and cold oil are discharged at infrequent intervals. Due to this extremely low catalyst carryover no recirculation is necessary to return the catalyst to the system.

A TCC unit is put on stream by circulating catalyst through the kiln and the reactor with the bucket elevators, the catalyst meanwhile being brought up to temperature by supplying preheated air to the kiln. When the proper temperature of catalyst has been reached the reactor charge stream which has been flowing through a by-pass around the reactor is cut in slowly by means of motor-operated valves to the reactor, after which the by-pass valve is closed and the unit is on stream. As soon as the hydrocarbon is fed to the reactor coke is deposited on the catalyst. The tar separator during the startup period is operated to produce a reactor charge of lighter gravity than the normal charge so as to lay down a reduced amount of carbon initially and enable gradual adjustment of kiln conditions until the unit is fully onstream.

In operating the reactor at constant throughput for a desired product three variables are subject to control. They consist of the catalyst temperature entering the reactor, the catalyst circulation rate, and the vapor temperature entering the reactor. Each one of these variables is subject to simple control and optimum conditions are easily obtained and maintained thereafter. A fourth variable on some units has been the adjustment of space velocity accomplished by changing the catalyst bed depth by means of adjustable feed pipes.

Kiln Design Prevents Overheating

In a TCC kiln with the low catalyst circulating rate used, if all the carbon were burned by merely introducing the theoretical quantity of air at the bottom and blowing it through the catalyst bed in one pass, the heat liberated would cause a temperature rise of the order of 800° to 1200° F. in the catalyst. Consequently, the kiln is divided into zones from 5 to 12 in number depending upon the amount of carbon to be burned as determined for design purposes by pilot plant runs on the refiners' charge stock. A kiln zone consists of a bed of catalyst having residence time of the order of 5 to 10 minutes into which combustion air is introduced at the middle, the air flowing both upward and downward to outlet flue gas collectors above and below the inlet distributors. The quantity of air supplied and the temperature of the air are controlled for each zone so that the temperature of the catalyst in the zone rises about 150° F. to a maximum of 1100° F.

When the catalyst has reached 1100° F., which is well below the safe operating temperature, it continues in its descent over a bank of cooling coils where the temperature is reduced to about 950° at which temperature the catalyst enters the next zone below, where the same procedure is repeated. In the upper zones of the kiln the

amount of carbon burned off in each zone is of the same magnitude, but as the carbon burn off progresses a longer time is required to burn off the remaining carbon. Consequently, the residence time in the lower zones increases and the residual carbon is burned off more slowly until at the bottom or clean-up zone the residence time is of the order of 20 minutes. In the upper zones the outlet flue gas is high in CO_2 and H_2O, most of the oxygen having been consumed. The flue gas from the bottom zone is high in oxygen since at this time carbon concentration has been reduced so that a high oxygen concentration is necessary to achieve the very low final residual carbon on catalyst obtained in the TCC kiln. The lowest bank of cooling coils is used for a final adjustment of kiln outlet temperature; i.e., reactor inlet temperature.

Kiln variables which are subject to control are the inlet air rate, the inlet air temperature, and the number of cooling coils in service. Any one of these three variables can be changed to maintain close control of the kiln. Best operation to date has been accomplished by leaving all cooling coils in service, and by merely manipulating air temperatures and air rates to the various zones stable kiln conditions with excellent carbon burnoff are accomplished.

The inlet air temperature to the kiln is controlled by the addition of heat in an air line burner. Line burners may be fired with gas or oil and operate at the pressure of the air inlet duct system which is in the range of 1 to 2 psi.

The blower supplying combustion air operates at a discharge pressure of 1-1.5 to 2 psi and handles cold air only. At this low discharge pressure and with air quantities in the range of 10,000 to 25,000 cfm the hp requirement for this blower is in the range of 100 to 300 hp. The combined hp required for supplying regenerating air and circulating catalyst consequently is a relatively low figure.

Materials of kiln construction are selected for the conditions existing or anticipated in the kiln. Low chrome alloy construction is used for the air distributors and collectors. The kiln walls are internally insulated and refractory lined. Cooling tubes are 1¼ chrome alloy. The balance of material in a TCC unit is carbon steel except as altered by specific corrosive conditions. The reactor-kiln section of the TCC unit may be modified to permit handling of corrosive stocks for a minor increase in installation cost. Equipment in a TCC unit is generally of standard-type readily obtainable and maintenance work can be easily handled by labor normally used in any refinery.

The steam generating system in the TCC unit operates on the principle of

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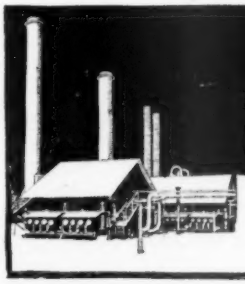

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forced circulation of feed water to the kiln cooling coils. The circulating pump has a capacity of 300 to 500 gpm which is many times the feed water rate actually required for the steam generated. Consequently, the mixture of steam and water from the kiln is returned to the drum from which the pump takes suction, where the steam is flashed, passes through a demistifier and thence to the plant steam system. The steam drum is located near ground level where all controls are readily accessible. Scale deposit in the kiln tubes has been negligible due to the fact that the tubes operate flooded with water. Although it would be possible to use all welded coil construction, it is considered desirable to use a removable plug type of header on one end of the tube coils so that they can be inspected or cleaned if necessary.

The designing of a TCC unit for capacities in the range of 1000 to 5000 b/d posed the problem of retaining all the inherent simplicity and safety features of the larger TCC units and at the same time providing a low cost unit. Actually it has developed that the features of simplicity and low cost are closely related so that in the small TCC units now available, simplicity and safety have been retained and the cost reduced well below that of the scaled-down versions of the conventional early designs.

These results were obtained by condensing the size of the equipment, combining equipment where possible and omitting features and equipment proved unnecessary by experience. For example, in the early designs a separate hot catalyst storage drum is installed to contain the catalyst when the unit is shut down and the reactor and kiln are to be inspected. In the low cost TCC unit this storage space has been placed above the reactor and surrounding the seal leg which necessarily must be about 50 ft. high. The reactor, hot catalyst storage drum, and reactor feed hopper are thus built and erected as one vessel at a marked saving in cost.

In small TCC units the regenerated catalyst circulating rate can be reduced to 50 to 75 tons/hours. This permits the use of a single elevator instead of two elevators, the single elevator being of the same standard design as on the large units with the exception of the elevator bucket arrangement. The spent catalyst and the regenerated catalyst are handled in the same bucket by the device of providing separate compartments in the bucket for each. In this arrangement the colder spent catalyst is placed in compartments on each end of the buckets next to the chain and the hotter regenerated catalyst in the middle compartment. An elevator chain has been found to operate more than 100° F. below the adjacent catalyst, the chain temperature will be in the range of 750° to 800° F.

The only cyclone separator to be installed will be that provided at the discharge of the elutriator where on a 100 ton/hour unit about 1500 lbs./day of fines and dust is removed during elutriation. Experience has shown that cyclone separators in the flue gas outlet ducts from the kiln are unnecessary, as little or no dust carry-over has been encountered except in the few cases where leakage due to a mechanical detail existed. The elutriator used for the purpose of controlling catalyst size has been located relatively close to ground level and arranged in combination with the fines bin and cyclone separator where all of this equipment is more easily accessible.

A considerable saving in structural steel is accomplished on the new small TCC unit design by utilizing the inherent strength of the kiln and reactor as structures to support all platforms required and to furnish top guides for the bucket elevator which is located between them. In addition to these major changes which in no way affect the ruggedness, safety, and flexibility of the TCC unit, a great many improvement in mechanical details have been made as a result of experience with the units now operating. The new small units will operate on natural clay or synthetic catalyst interchangeably. It may be said that in all respects the small sized TCC unit is equal to the large units and in many respects it will be a more closely integrated unit.

Economics

To illustrate the advantages to be gained by the installation of TCC equipment an economic study has been prepared for what is considered a typical refinery situation. It has been assumed that a refinery processes 5000 bpcd of typical Mid-continent type crude in top-

SUPPLEMENTAL TABLES

TABLE A—TCC Unit Yields

Feed—BPCD	Case A	Case B
Virgin Gas Oil	2000	2000
Vacuum Gas Oil	...	450
Visbreaker Gas Oil	315	....
Visbreaker Gasoline	97	....
Total Fresh Feed	2412	2450
Recycle Gas Oil	2315	2450
Total Reactor Throughput	4727	4900
Yields on Fresh		
Butane Free Gasoline, Vol. %	65.0	64.8
Butenes, Vol. %	5.6	5.8
Butanes, Vol. %	9.4	9.5
Cycle Gas Oil, Vol. %	16.3	15.1
Dry Gas (F.O.E.), Vol. %	10.2	10.4
Propylene, Vol. %	5.2	5.5

TABLE B—Thermal 2 Coil Cracking Yields

Reduced Crude Charge—BPCD	2750
Butane Free Gasoline, Vol. %	44.7
Butenes, Vol. %	2.2
Butanes, Vol. %	3.0
Tar (8° A.P.I.) Vol. %	42.5
Dry Gas (F.O.E.) Vol. %	12.4
Propylene, Vol. %	3.0

TABLE C—Thermal Reformer Yields

Feed	Base Case	Case A	Case B
Virgin Heavy Naphtha—BPCD	900	640	640
Octane No. CFR-M	37.0	34.5	34.5
Yields			
Butane-Free Gasoline, Vol. %	71.0	84.0	84.0
Butenes, Vol. %	4.5	3.3	3.3
Butanes, Vol. %	4.5	3.2	3.2
Tar, Vol. %	4.5	2.5	2.5
Dry Gas (F.O.E.), Vol. %	15.7	7.9	7.9
Propylene, Vol. %	4.0	3.0	3.0
Gasoline Octane No. CFR-M (C_4 Free)	67.5	57.0	57.0

TABLE D—Total Motor Gasoline Octane Numbers

Total Gasoline (10 lbs. RVP)	Base Case	Case A	Case B
CFR-M (Clear)	66.7	69.9	70.3
+ 1cc TEL/Gal.	74.5	76.8	77.1
+ 2cc TEL/Gal.	77.0	80.0	80.3
+ 3cc TEL/Gal.	79.0	82.0	82.2
cc TEL to 79.0 CFR-M	3.00	1.60	1.50

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TABLE 3—Price Structure and Utility Values for Cases Illustrating TCC Processing

Feed and Products	Price
Mid-Continent crude, $/bbl.	1.40
Housebrand gasoline (78 CFR-M), c/gal.	6.00
Premium gasoline (83 CFR-M), c/gal.	7.00
Kerosene, c/gal.	4.25
Fuel Oil (No. 6), $/bbl.	0.90
Excess Butanes (above 10 lbs. RVP Gaso.), c/gal.	1.45
Fuel Gas, c/MBTU	15.00
Utilities	
Steam (h.p.), $/M lbs.	0.24
Power, c/K.W.H.	0.70
Cooling Water, c/M gal.	0.50
Treated Water, $/M gal.	0.15
Clay catalyst, c/lb.	4.00
Labor (avg. rate), $/man hours	1.30

TABLE 4—Direct Operating Costs of TCC Feed Preparation & Cracking

CASE NO:	"A"	"B"
FRESH FEED—BPCD	2412	2450
TOTAL FEED—BPCD	4727	4900
ITEM	**$/Day**	**$/Day**
Operating Labor (4 men/shift @ $1.30)	125	125
Supervision and Payroll Burden	31	31
Works Expense	70	70
Maintenance (Labor and Material)	123	110
Catalyst	120	120
Utilities:		
H.P. Steam @ $0.24/M lb.	18	—6*
Power @ 0.7c/KWH	7	6
Cooling Water @ 0.5c/M Gal.	17	15
Boiler Feed Water @ $0.15/M Gal.	6	6
Fuel @ $0.15/MM Btu.	153	135
Total Direct Operating Cost	$ 670†	$ 612†
c/Bbl. Fresh Feed	27.8	25.0
c/Bbl. Total Feed	14.2	12.5

*Net Production of H.P. Steam.

†Includes operating expense of visbreaker circuit.

‡Does not include vacuum tower operating expense.

ping, two coil thermal cracking and naphtha reforming equipment. The two cases illustrating TCC processing are based on revamping of existing equipment and addition of a TCC reactor-kiln section for processing the material presently going to two-coil thermal cracking.

Cases Being Considered

The cases considered are briefly outlined as follows:

BASE CASE—Present operation, crude topping, two-coil reduced crude cracking, deep naphtha reforming and catalytic polymerization of C_3 and C_4 unsaturates.

CASE "A"—Crude topping, moderate naphtha reforming, TCC 1/1 recycle cracking of overhead from flashing reduced crude with integral visbreaker circuit for flash tower bottoms; catalytic polymerization of C_3 and C_4 unsaturates.

CASE "B"—Crude topping, mild naphtha reforming, TCC 1/1 recycle cracking of overhead from reduced crude flash and vacuum flash towers; catalytic polymerization of C_3 and C_4 unsaturates.

The cases presented are based on the assumption that 600 bpcd (12%) of kerosine would be marketed. The price structure and utility values used are listed in Table 3.

The gasoline price of 6.25 c/gal. is

TABLE 5—Summary of Economics for Cases Illustrative of TCC Processing

CASE NO.:	Base Case			Case "A"		Case "B"	
Revenue	c/Gal.	B/CD	$/Day	B/CD	$/Day	B/CD	$/Day
10 lbs. RVP Motor Gaso.	6.250	2814	7387	3467	9101	3499	9185
Kerosine	4.250	600	1071	600	1071	600	1071
Residual Fuel	2.145	1210	1089	727	654	687	618
Dry Gas (F.O.E.)	2.145	437	393	287	258	271	244
Excess Butane	1.450			26	16	12	7
Total Revenue			$ 9,940		$11,100		$11,125
Operating Costs							
Crude	3.33	5000	$ 7000	5000	$ 7000	5000	$ 7000
Crude Distillation		5000	300	5000	300	5000	300
Vacuum Reduction						750	89
T.C.C. Cracking				2412*	670	2450†	612
Thermal Reforming		900	168	640	146	640	146
Thermal Cracking		2750	400				
Debutanization			18		20		20
Catalytic Poly.		92	115	166	153	170	157
Gasoline Inhibitor		2814	3	3467	3	3499	3
Taxes, Interest, Insurance (Incremental)			21		134		154
T.C.C. Royalty				2412	121	2450	123
Thermal Royalty		2750	83				
Cat. Poly. Royalty		92	19	166	35	170	36
TEL To 79 CFR-M (Mcc's)		355	638	233	419	220	396
Total Operating Costs			$ 8765		$ 9001		$ 9036
Earnings/Day			1175		2099		2089
Differential Payout Period					2.45 Yr.		2.92 Yr.
Investments (Process Equipment Only)							
Revamp Thermal and Install TCC Catalytic Section					$775,000		$800,000
Catalytic Polymerization			$150,000		$200,000		$200,000
Vacuum Distillation							$125,000
Total			$150,000		$975,000		$1,125,000

*Visbreaking and 1:1 Recycle Cracking. †1:1 Recycle Cracking.

based on 75% Housebrand (77.5 CFR-M) at 6.00 c/gal. and 25% (83 CFR-M) at 7.00 c/gal.

The above prices are, of necessity, arbitrarily chosen. For an individual refiner to obtain a true picture, his actual price structure should be substituted. The direct operating costs for the TCC feed preparation and cracking section are appended in Table 4.

The three schematic flow diagrams in Fig. 3 show the process schemes outlined above. Basic yields, capacities of the various refining units and clear and leaded octane numbers of blended gasolines are shown in supplementary tables A, B, C, and D.

Table 5 gives a complete summary of overall refinery economics for the three cases considered. Case A shows a payout period of 2.5 years based on the new investment required. Case B, on the basis of cutting back asphalt for fuel oil production, shows a slightly lower return on a large investment. This case, however, gives greater flexibility in that fuel oil, or asphalt, or both may be produced as market requirements dictate. For those refiners who produce asphalt or lube oil this plan might be of considerable interest. Evaluation of asphalt product at any price higher than fuel oil value will, of course, increase the earnings of this case.

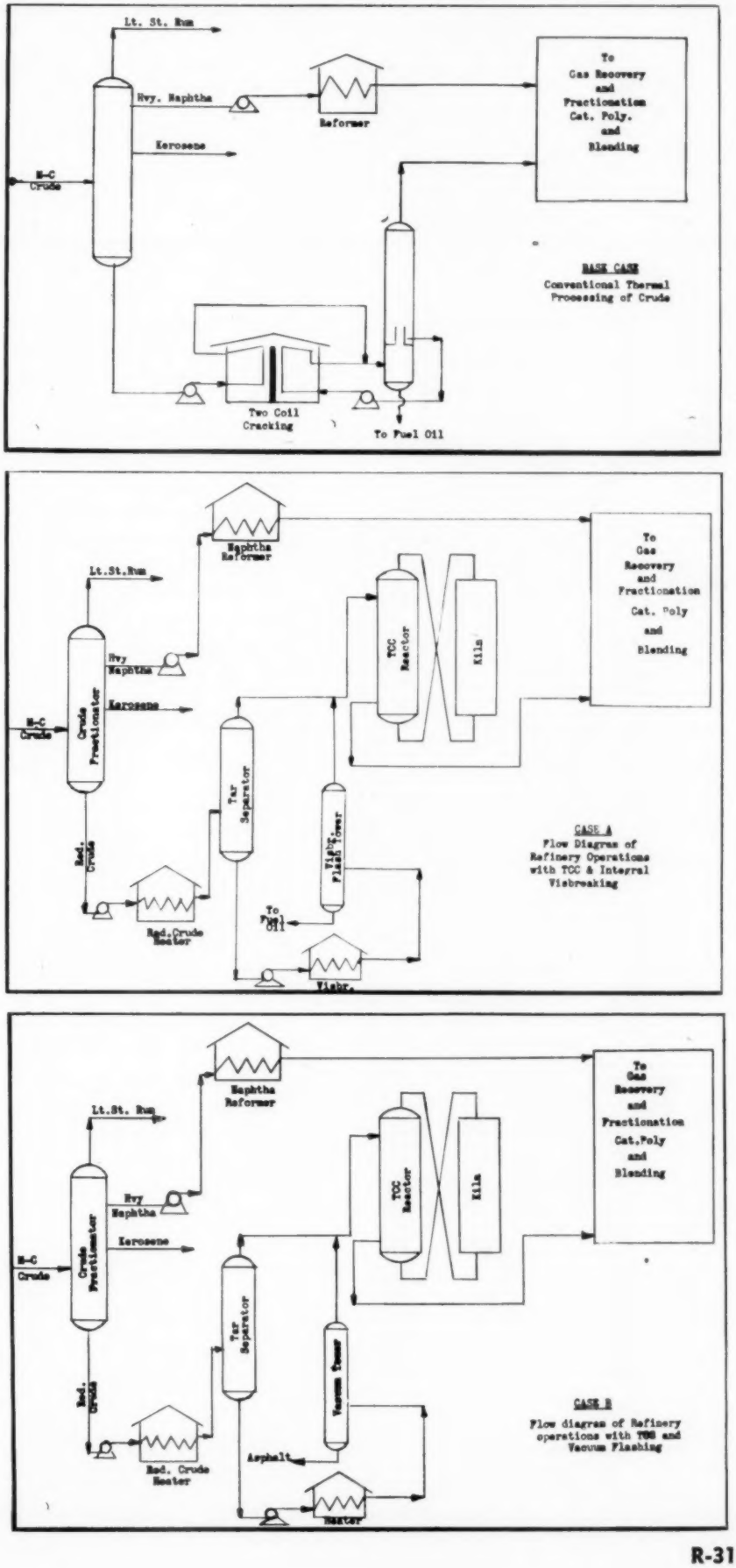
Gasoline Yield Is Increased

From a study of the distribution of refinery products with and without the TCC unit it is immediately apparent that a considerable increase in gasoline yield is obtained by the installation of TCC equipment. This increase is obtained from a decrease in fuel oil and fuel gas.

The major effects of the catalytic installation on the composition of overall refinery gasoline are a slight increase in catalytic polymer, butanes and light straight-run and a decrease in reformed naphtha. Cracked gasoline, thermal or catalytic, remains nearly constant, being slightly higher in Cases A and B than the base case. The lower reformed naphtha and the higher butanes in the gasoline are explained by the fact that, with the installation of the TCC equipment, it is not necessary to reform as severely as in the thermal case to reach the same octane level and lead requirement for the motor fuel. The reforming operation has therefore been reduced both in charge rate and severity. This results in a smaller quantity of lower octane number reformed naphtha and a greater requirement of butane to make constant vapor pressure total gasoline.

The small TCC unit will answer the postwar quality problem for operators of small refineries by producing higher yields of excellent quality gasoline at a reasonable manufacturing cost, and by providing ample allowance for further increases in quality should the competitive situation so demand.

Fig. 3—Diagrams Illustrating TCC Processing Arrangements



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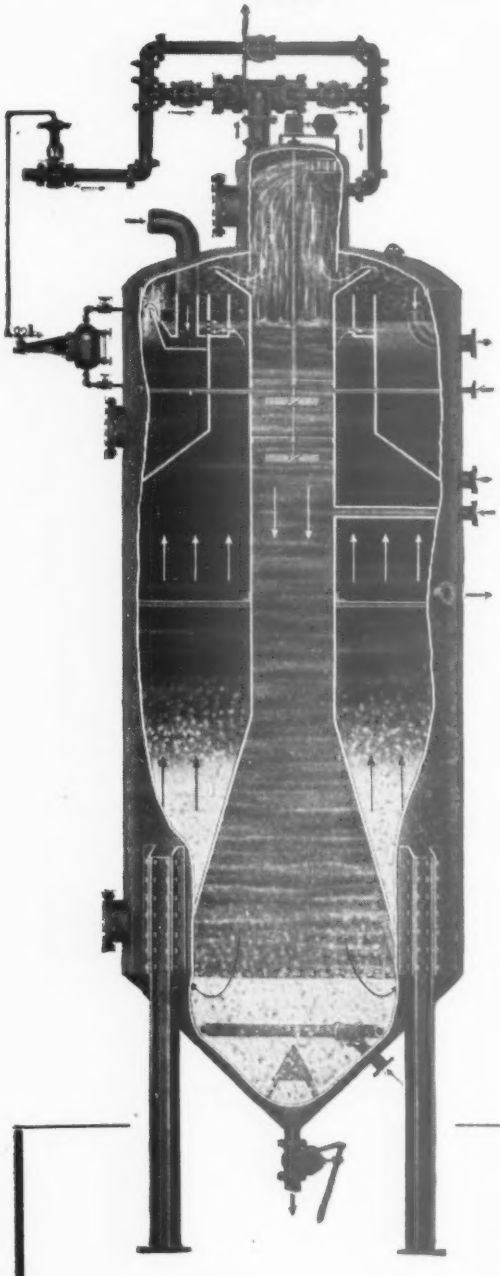

Cross-section view of the Graver Hot Process Water Softener showing how sludge recirculation and sludge contact is provided for in the sedimentation tank.

For continuous trouble-free boiler operation, a completely softened water is required. Silica, if present, must be removed from the water to prevent the formation of hard flint-like silica scale in boilers. Numerous chemicals are available which form precipitates in the water to remove silica during the softening process, but silica removal is only partially a chemical problem. Mechanical design of the Silica Removal equipment is also highly essential.

A most important step in silica removal is sludge recirculation and the mixing of such sludge with the heated incoming water. In addition, contact of the water being treated with the sludge in the sedimentation tank should be intimate and sustained, which at controlled velocities provides a finished water with a lower silica content than that obtained from ordinary settling tanks.

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Improved Fluid Unit Meets Needs of Smaller Refiners

By Davis Read

Commercial Development Dept., Universal Oil Products Co.

Simplification of the Fluid Catalytic Cracking unit has reduced investment and operating costs to the point where this process now compares favorably with the economics of thermal cracking.

Principal changes in design include: (1) Combination of reactor and regenerator into a single self-supporting column, (2) elimination of all secondary catalyst recovery equipment when a micro-spherical catalyst is employed, (3) use of additional distribution grids in both reactor and regenerator, and (4) addition of an external stripper and redesign of the reactor stripper.

These and other design changes are described in the following article dealing with the evolution of the original 10,000 b/d Fluid units to their present size of 2600 b/d and smaller.

MOST of the catalytic cracking units constructed during the war had a nominal capacity in excess of 10,000 b/d, although a number of smaller units of 4000 to 5000 b/d capacity were also operated very successfully to produce aviation gasoline components. The smallest fluid catalytic cracking unit, having a capacity of 2600 b/d, has been in operation for nearly 2 years and is presently producing motor fuel.

Considerable development work was done on each of these units for the purpose of increasing throughput and improving the efficiency of operations to produce the maximum amount of aviation gasoline components. The data thus obtained have permitted a revision of the original factors used in the design so that it is now possible to build less expensive, more efficient equipment to produce high quality motor fuel.

The 2600 b/d unit took advantage of revised design factors to some extent and incorporated several features which have proved advantageous in the construction of small units. The present simplified UOP design has been a logical development of the fluid cracking process, as illustrated in Fig. 1. These flow diagrams, which are drawn approximately to the same scale, show briefly the stages in the development of the present simplified unit.

The left-hand portion of Fig. 1 shows the typical down-flow type of construction which was embodied in many of the smaller (5000 b/d) fluid cracking units operated during the war. Raw oil enters the system at the base of the regenerated catalyst standpipe. The heat in the catalyst vaporizes the oil, and the mixture of oil vapors and catalyst flows upward through a riser into the reactor.

Vapor velocity is such that the catalyst suspended in the oil vapors falls back and forms a dense layer on the grid plate. Oil vapors pass through this dense catalyst bed where the cracking reaction takes place and the cracked products then pass through a centrifugal separator where entrained catalyst is removed, the vapors passing on to a fractionating column.

Since the fine catalyst powder used in these plants cannot be entirely retained by the cyclones, it is necessary to return the catalyst carried into the fractionator to the cracking section by recycling tower bottoms or slurry oil.

Catalyst Stripped With Steam

Spent catalyst leaving the reactor is stripped by steam to remove entrained oil vapors and then descends through a standpipe to the point where air is introduced. The air required for burning the carbon formed in cracking carries the spent catalyst up through a long riser into the regenerator. Both the riser and the regenerator are lined with refractory brick.

Regenerated catalyst separates by gravity, settles back into a dense fluid phase and flows downward through a standpipe to meet the incoming raw oil. The products of combustion pass out through cyclones to remove entrained catalyst, through a waste heat boiler and finally through a Cottrell precipitator, where most of the remaining catalyst is recovered. The fines recovered from the Cottrell are returned to the regenerator.

Thus it is seen that there are three principal flowing streams in the fluid process:

1. Oil passes through the reactor to the fractionator.
2. Air for regeneration of the cat-

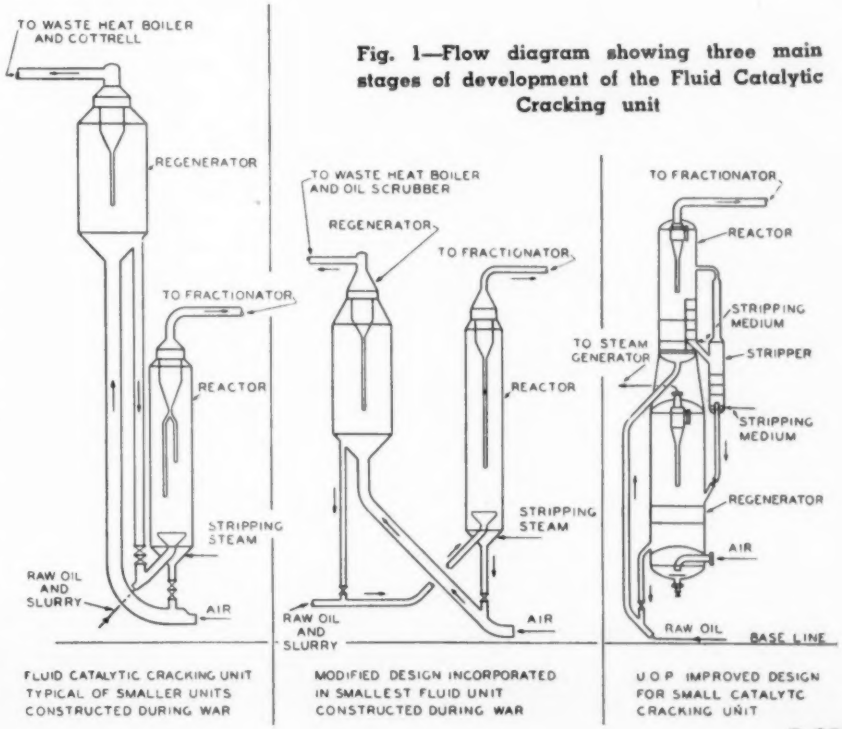

Fig. 1—Flow diagram showing three main stages of development of the Fluid Catalytic Cracking unit

This paper was prepared for presentation before the Western Petroleum Refiners Assoc., Fort Worth, March 26, 1946, under the title "A Fluid Catalytic Cracking Unit for the Small Refiner."

LATEST INFORMATION

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Two recognized authorities on the science of lubrication discuss the important advancements made in this field in the books described below.

William G. Forbes, well known Lubrication Engineer and author of two of the three books, was the writer of a regular feature on Industrial Lubrication in the TECHNICAL SECTION of National Petroleum News.

George G. Pritzker, author of the series on lubricating oil additives, originally published in NPN'S TECHNICAL SECTION, is a Chemical Engineer and U. S. Patent Examiner. A graduate of Brooklyn Polytechnic Institute, Mr. Pritzker spent 8 years in the Freeman Chemical Company grease department. For the past 3 years, he has been with the U. S. Patent Office examining patent applications on various lubricating compositions and lubricating oil additives.

LUBRICANTS AND CUTTING OILS FOR MACHINE TOOLS by William G. Forbes—Covers the fundamental principles of lubrication in relation to metal cutting and the application of various types of cutting oils to machine tool operations. Discusses the various properties of lubricating and machine oils, their relative importance, and methods of testing; suggests points to be covered when specifying lubricating and cutting oils. Explains in detail the composition, compounds and blends, and practical application of cutting oils . . . Also deals with lubricating greases, the mechanics of metal cutting and the treatment and prevention of skin diseases resulting from contact with lubricants . . . 90 pages . . . Size 5½ x 8½. Cloth bound . . . $1.50

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alyst passes once through the regenerator.

3. Catalyst itself circulates within the system.

Catalyst circulation rate depends upon the pressure differential across the slide valves. The higher pressure above the slide valve is the sum of the pressure in the top of the vessel and the static head created by the dense catalyst in the vessel and standpipe. In this type of unit the regenerator pressure is fixed by the back pressure on the outlet line at 1 to 4 psi, depending upon whether or not a restriction grid is installed in this line. The pressure above the slide valve then depends largely on the catalyst density in the vessel and standpipe. The pressure below the slide valve is low because of the lower density of air, or vapors, and catalyst in the riser.

It was found that the catalyst finally developed and used during the war increased considerably in density during service. Consequently, the pressure drop available for causing circulation was much greater than the design basis. Since more pressure drop was available than that required for the specified cracking operation in the original downflow units, it follows that the static head or overall height of the regenerator can be decreased, thus reducing the installation cost.

For the smaller units it is also entirely feasible to install a pressure control valve in the regenerator outlet and operate this vessel under pressure, again decreasing the height of the vessel above grade. These two features were incorporated in the design of the 2600 b/d unit.

The center section of Fig. 1 shows a flow diagram of this modified design. The reactor pressure is approximately 9 psi in this modified unit and the regenerator pressure is about 10 psi. Aside from permitting a decrease in the overall height of the regenerator, the higher regenerator pressure results in an improved carbon burning rate.

Even though the overall height was decreased from 180 ft. in the original downflow design to 100 ft. in the modified design, the available driving force is still more than required for good catalyst circulation. This unit has circulated catalyst successfully with 2 to 3 psi pressure drop across each slide valve, although the available pressure drop is much greater.

Several other improvements in design for smaller units were incorporated in the 2600 b/d unit. The Cottrell precipitator was replaced with an oil scrubber which removes the catalyst fines from the regenerator gases almost completely. The risers do not contain refractory lining which has caused some difficulty in other units.

The right-hand section of Fig. 1 illustrates the newer fluid catalytic cracking unit design, which includes the improvements previously described as well as several additional features which increase efficiency. Since commercial tests show that it is entirely feasible to operate with a slide valve pressure drop of 3 psi, the next logical step is to lower the larger regenerator vessel still farther. This permits the regenerator to be placed below the reactor and in smaller sizes the reactor can be supported by the regenerator, thus eliminating the heavy structure required for support in the older design. The overall height of a 3300 b/d unit is approximately 125 ft.

Process Flow of Latest Design

Briefly, the flow through this unit is as follows: The oil feed is charged as a liquid at the base of the reactor riser. Hot catalyst from the regenerator enters the riser at the point of oil injection, supplies the process heat requirements and is transported upward by the vaporized oil into the reactor. Spent catalyst is continuously withdrawn from the upper part of the reactor dense phase to hold a level in the reactor and passes downward through the stripping section into the regenerator.

Three zones are available for stripping in this design. The stripping medium is injected at the bottom of both the internal and the external strippers. Additional stripping of the spent catalyst is obtained in the upper section of the regenerator where the bulk of the flue gas from the combustion of coke in the lower sections contacts the incoming catalyst. The catalyst passes downward through the regenerator countercurrent to the air supplied at the bottom for regeneration.

Regenerated catalyst flows from the lower section of the regenerator to the reactor riser at a rate controlled to maintain a constant reactor temperature. The regenerator flue gas is vented to the atmosphere through an internally mounted cyclone separator which recovers entrained catalyst. The reaction products pass to the fractionator through a second internally mounted cyclone separator which recovers entrained catalyst and returns it to the catalyst bed. A comparison of the three diagrams in Fig. 1 will show that the principle of catalyst circulation from one vessel to another by transfer from a zone of high density through a zone of low density is the same in all three units.

It has been demonstrated that the installation of distribution plates improves the efficiency of contacting of oil and catalyst in the reactor, resulting in a higher liquid recovery and less gas formation. The installation of additional grid plates in the regenerator and stripper results in an improved carbon burning rate and stripping efficiency with a decrease in operating costs. These improvements have been incorporated in the new design.

By building the regenerator below the

reactor it is now possible to pass the air for regeneration countercurrent to the flow of catalyst. With the countercurrent flow and staging of the regenerator with grid plates the oxygen content of the outlet gas can be reduced to ½ to 1%, while in previous units 2 to 3 times as much unused oxygen normally escapes from the regenerator. This feature of the new design was not possible in the older units. A detailed discussion of these improvements in efficiency which have been incorporated in the new design has been previously given in the literature[1].

Control of Operations

Fig. 2 illustrates the system used for controlling the operation of the simplified unit. The reactor temperature controls the flow of catalyst through the regenerated catalyst slide valve and the reactor level controls the flow through the spent catalyst slide valve. The reactor pressure is held constant by the gas compressor and regenerator pressure is held constant by the rate of release of flue gas, with the valve in the flue gas line controlled by the pressure difference between the reactor and regenerator.

This method of control is used on the 2600 b/d unit and has several advantages. The pressure drop across the slide valve does not vary appreciably, since both the vessel pressures rise and fall together in the event of surges in either the air or gas compressors. The catalyst flow is very uniform and responsive to changes made in the instruments.

The cracking reaction, as measured by the per cent yield of cycle stock or by the gas rate, is controlled at constant throughput by varying the reactor level or temperature. An increase in either the reactor level or the temperature increases the conversion. In order to control the burning reaction an analysis of the regenerator outlet gas stream is obtained and the carbon content of the catalyst is determined periodically. The regeneration is then controlled by varying the air or carbon production rate.

Catalysts

The simplified unit can utilize either synthetic or natural catalyst. In its most simple design synthetic catalyst having a microspherical form is used. Due to the spherical shape of the particle and its greater strength, as compared with the ground powdered catalysts used during the war, this catalyst has very low erosion and attrition rates. In addition, the MS catalyst is much more uniform in particle size than the ground catalyst. This permits the design of this unit without the use of secondary recovery equipment such as a Cottrell precipitator, oil scrubber, or slurry pumps.

The synthetic microspherical catalysts composed of either silica-magnesia or silica-alumina are available. Since the natural catalyst is lower in cost per

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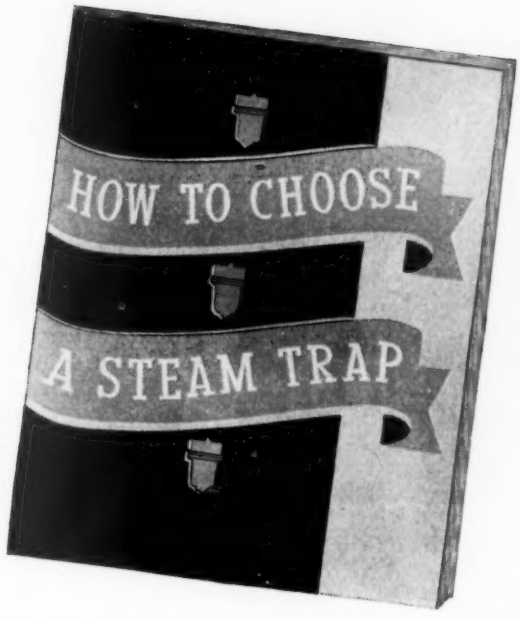

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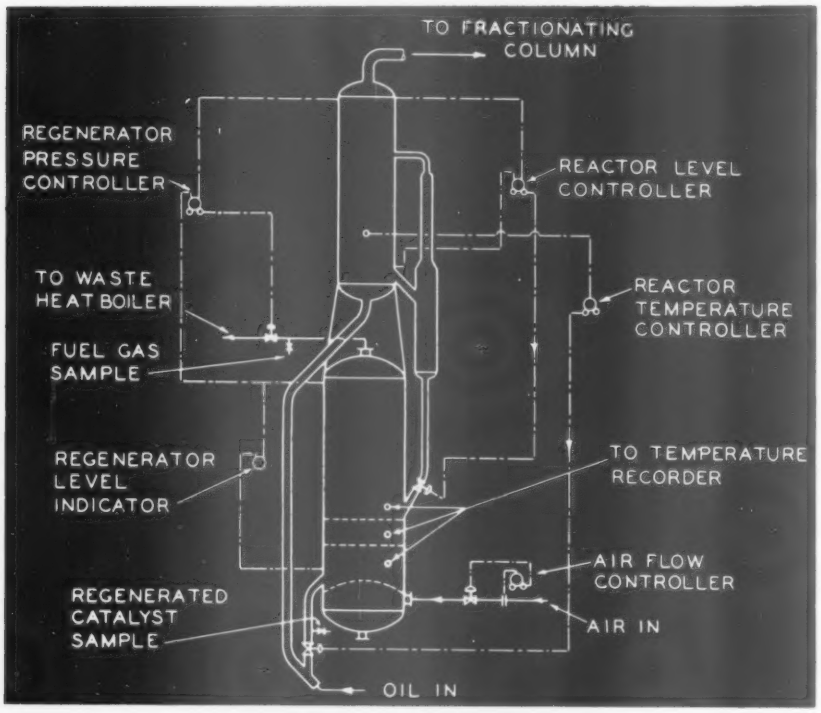

Fig. 2—Control system for the simplified Fluid Catalytic Cracking unit, as designed for a 2600 b/d plant

pound than either of the synthetic catalysts, its use must also be considered. When natural catalyst is used, however, secondary recovery equipment must be added to the MS unit. This equipment consists of an oil scrubber or Cottrell to recover the fines from the regenerator outlet gas and pumps to return catalyst slurry from the fractionator to the reactor.

Economic consideration of market requirements and operating costs will govern the choice of catalyst. The silica-alumina catalyst gives the highest octane number and lowest gasoline yield, while considerably more gasoline having a lower octane number is produced from the silica-magnesia catalyst. The natural catalyst gives a gasoline yield and octane rating intermediate to the values obtained by the two synthetic catalysts.

The catalytically cracked gasolines produced from each catalyst have blending octane numbers considerably higher than their rated values when blended with straight run gasoline. This blending value varies with the quality of the straight run and percent of catalytically cracked gasoline in the blend. For example, a catalytic gasoline having an ASTM octane rating of 81 would have a blending octane rating of 89 ASTM when blended with 70% of straight run having a 53 octane rating. The research method blending value of the catalytic gasoline would be approximately 110 in this example.

Methods of Processing

The flexibility of the fluid cracking process has been well demonstrated by units now in operation. Various charging stocks, including naphtha, kerosine, gas oil, and topped crude, have been processed commercially at temperatures ranging from 800 to 1000°F. in either once through or recycle operation. This same degree of flexibility can be obtained in the improved MS unit.

With the present limited gasoline and maximum fuel oil demand the operation of a catalytic cracking unit at extremely high conversion does not appear advantageous. To meet present market demands a refiner would, therefore, probably operate a fluid catalytic cracking unit at an intermediate conversion level of 55-65% to produce both gasoline and burner oils. Since the cracking reaction can be controlled by varying the amount of catalyst in the reaction zone, it is possible to return a part of the cycle stock to the reactor without reducing the net yield of cycle stock. By reducing the level of catalyst in the reactor and recycling a part of the cycle stock, the conversion per pass is decreased.

This operation increases the gasoline and butylene yield and decreases the yield of dry gas and butanes, as shown in Table 1. The decreased conversion per pass reduced the ASTM (F-2) octane numbers of the debutanized gasoline, but had no indicated effect on the Research (F-1) octane ratings at the conversion and temperature level under which these tests were made. Note that the cycle stock became lighter in gravity in going from once-through to recycle operation at a constant conversion or yield of cycle stock.

As previously described, the heat required to vaporize the raw oil in the fluid catalyst process is supplied largely by direct heat transfer between the raw oil and the hot regenerated catalyst. The simplest design of the new unit is, therefore, based on processing a given amount of liquid feed in once-through operation at conditions under which there is a balance between the heat released in regeneration and the heat absorbed in processing.

A unit designed for once-through operation can, of course, recycle at a lower raw oil throughput than the maximum capacity obtainable in once-through operation. The limiting raw oil throughput may be set by the size of the reactor or fractionator since certain maximum vapor velocities cannot be exceeded in these vessels. Further, it is necessary to supply additional heat to the reactor when recycling in order to maintain a heat balance in the catalyst section. This is usually done by installing

TABLE 1—Comparison of Once-Through and Recycle Operation

Basis: Fluid Catalytic Cracking of Mid-Continent Gas Oil, 65% Conversion, natural catalyst

	Once-Through	1.67 CFR
Yields, Vol. %		
Debutanized Gasoline, Vol. %	48.9	50.5
Cycle Stock, 400° F.+, Vol. %	35.0	35.0
Butylenes, Vol. %	5.8	6.5
Butanes, Vol. %	7.4	5.5
C_3 and Lighter, Wt. %	6.6	5.4
Debutanized 400° F. E.P. Gasoline		
Octane No. ASTM (F-2)		
Clear	80.3	79.2
+ 3cc. TEL	86.3	85.5
Octane No. Research (F-1)		
Clear	90.8	90.8
+ 3cc. TEL	96.5	96.5
Cycle Stock, 400° F.+		
Gravity, °API	26	28

TABLE 2—Estimated Normal Utility Requirements, 2000 b/sd Fluid Catalytic Cracking Unit

Basis: 60% conversion of Mid-Continent gas oil, catalyst section and fractionator through gas compressor

Steam, lbs./hr.	
Required (150 Psi)	
Pumps	3000
Stripping	1000
Total	4000
Produced (150 Psi)	
From column bottoms steam generator	5500
Net Produced	1500
Electricity, KW	
Lights and Power	15
Fuel Gas, MM Btu/hr.	
Required	
Gas Compressor	3
Air Compressor	5
Total	8
Produced	
After polymerization	31
Net Produced	23
Cooling Water (85°F. Max. Inlet), gal./min.	
Main Condenser	250
Gas compressor cooling	150
Cycle oil coolers	100
Total	500

TABLE 3—Summary of Operating Costs, 2000 b/sd Fluid Catalytic Cracking Unit

Basis: 60% conversion of Mid-Continent gas oil; catalyst section, fractionator and gas compressors

Item	$/CD
Operating Supervision	
Foreman @ $350/mo.	11.70
Operating Labor	
1 Operator @ $1.50/hr., 24 hrs.	36.00
2 Helpers @ $1.25/hr., 48 hrs.	60.00
Utilities	
Steam, 1500 lbs./hr. @ 25c/M lbs.*	8.10
Fuel Gas, 8.0 MM Btu/hr. @ 15c/MM Btu	25.90
Water, 500 GPM 1c/M gal.	6.50
Electricity, 15 KW @ 1c/KW	3.20
Catalyst	
½ lb./BCD chg. @ 15c/lb.	135.00
Maintenance (Labor and Materials)	100.00
Laboratory	
1 Tester, 24 hrs. @ $1.00/hr.	24.00
Chemicals, Materials, etc.	10.00
Royalty	
1800 b/cd @ 5c/bbl.	90.00
Taxes and Insurance	35.00
TOTAL	528.20
Cost per barrel of charge	29.3c

*Credit.

a preheater on the feed to the reactor, although some raw oil preheat may be obtained by heat exchange with the fractionating column bottoms.

A unit designed for recycle operation will cost somewhat more than a unit intended to process the same amount of oil in once-through operation at the same conversion. However, the increased liquid recovery obtained by recycling will offset the additional capital expenditure in many cases.

Utilities and Operating Costs

The utility requirements for the improved unit, of course, depend upon the type of operation, charging stock, and type of equipment used for heat exchange, pumping and compression. As a basis for discussion, the normal utility requirements were estimated for the catalyst and fractionating sections of a 2000 b/sd unit processing Mid-Continent gas oil at 60% conversion in once-through operation.

The utilities required to operate this equipment, which is illustrated on Fig. 3, are summarized in Table 2. The total steam required amounts to 4000 lbs./hr., but 5500 lbs./hr. of steam is produced from the column bottoms steam generator, resulting in a net steam production of 1500 lbs./hr. All of the pumps shown on this diagram are driven by steam and the air compressor is driven by a gas engine.

The total heat available in the fuel gas produced after polymerization would amount to 31 MM Btu/hr. It is estimated that 3 MM Btu/hr. of fuel gas would be used in driving the gas compressors required to feed the low pressure receiver gas into an absorber operated at 200 psi. An additional 5 MM Btu/hr. of gas is used for compression of the regenerating air. The net fuel gas available for the boiler house, or heating in other sections of the refinery, thus amounts to 23 MM Btu/hr. The total cooling water for the condenser and coolers amounts to 500 GPM. The electricity required for lights and power is estimated at 15 KW.

Using these utilities as a basis, the estimated cost of operating the equipment shown on Fig. 3 is summarized in Table 3. The total cost of operation amounts to 29.3c/bbl. of raw oil charge. Credit was taken for the net steam production in these calculations, but no credit was taken for the fuel gas production. With the operation of a stabilizer and absorber to prepare debutanized gasoline and a liquid C_3-C_4 feed to the polymerization unit, the total operating cost would be approximately 33c/bbl.

Summary

The stages in the development of the present simplified fluid catalytic cracking unit for the smaller refiner have been briefly discussed. The principal improvements in efficiency and the mechanical simplifications which have been made are listed below.

1. The reactor and regenerator have been combined into a single vessel which is erected as a self supporting column in the smaller sized units.

2. When micro-spherical catalyst is used all secondary catalyst recovery equipment, such as the Cottrell precipitator and a slurry settler or slurry circulating system on the processing side, has been eliminated.

3. The efficiency of both the reactor and regenerator has been improved by the use of additional distribution grids in each section.

4. The redesign of the reactor stripper, the installation of an external stripper, and the additional stripping obtained in the countercurrent regenerator results in a marked improvement in stripping efficiency and a reduction of regeneration requirements.

The improved method of controlling the new unit results in uniform catalyst flow and smooth operation. This method of control has been tested in the 2600 b/d commercial unit.

The flexibility of the fluid catalytic cracking process has been demonstrated by commercial units, which have processed stocks ranging from naphthas to topped crude at reactor temperatures of 800 to 1000°F. Various recycling operations and combinations of catalytic and thermal cracking operations have been investigated in both pilot plant and commercial units.

The reduced investment and operating costs now permit this process to compare favorably with thermal cracking investment and operating costs.

References

(1) Anderson, N. K., and Sterba, M. J., *Oil and Gas Journal*, 44 (33), pp. 77-88 (1945).

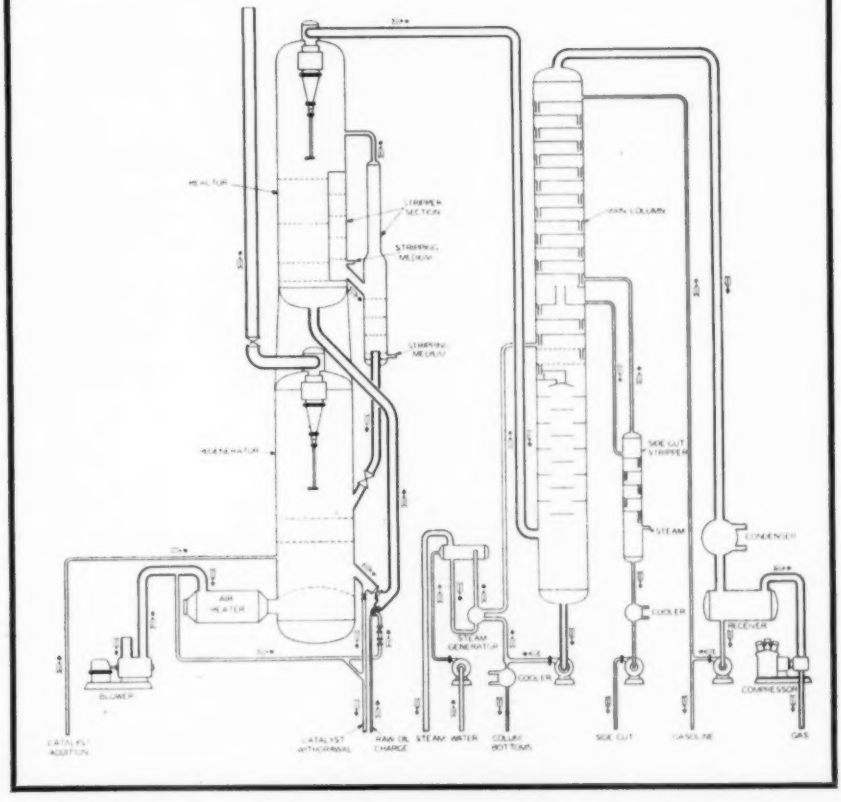

Fig. 3—Flow diagram of the cracking, regenerating and fractionating equipment for a 2000 b/d simplified Fluid Catalytic Cracking unit

Petroleum Technologists in the Headlines

T. Ellwood Webster, Rosemont, Pa., is president of the newly organized Catalytic Engineering and Construction Co., Philadelphia, which will engage in the design and construction of oil refineries and oil refinery equipment. It will specialize in catalytic cracking units employing processes licensed by the Houdry Process Corp., of both the fixed-bed and T.C.C. moving-bed type. Mr. Webster was formerly assistant to the president of Sun Oil Co.

Mr. Webster

Mr. Knight

Alan T. Knight, Claymont, Del., formerly manager of maintenance and construction at Sun's Marcus Hook refinery, is vice president of the new company. **W. Graham Jamison,** Cynwood, Pa., is secretary-treasurer. He was formerly chief accountant in the general accounting department in charge of petroleum compensatory adjustments for Sun Oil Co.

o o o

Arthur E. Pew, Jr., vice president of Sun Oil Co. in charge of manufacturing and research, is a director of the Catalytic Engineering and Construction Co. **Clarence H. Thayer,** chief engineer and a director of Sun, and **Robert G. Dunlop,** comptroller and a director of Sun, are also directors of the new company.

o o o

Hugh W. Field, assistant manager of the research and development department of Atlantic Refining Co., has been elected a director of the company. He joined the company in 1928 shortly after graduating from the University of Pennsylvania. During the war he was technical adviser to various committees on the development of aviation gasoline.

Mr. Field

James O. Lewis, Dunn & Lewis, Houston, was named Anthony F. Lucas Medalist for 1946 at the recent meeting of the American Institute of Mining and Metallurgical Engineers in Chicago. He has been an outstanding pioneer in production engineering. After working with various private interests in many oil fields he joined the U. S. Bureau of Mines in 1915 as chief engineer of the Petroleum and Natural Gas Division. He left the Bureau in 1920 to engage in consulting work.

o o o

R. A. Carter is in charge of the sale and purchase of natural gas and the sale of liquid products for Stanolind Oil and Gas Co., with headquarters at Tulsa. He was previously manager of the natural gasoline and gas division of Continental Oil Co.

o o o

Walter Miller, vice president in charge of manufacturing for Continental Oil Co., Ponca City, Okla., has retired from this position but will carry on consulting work in refinery processing. **Harold G. Osborn,** manager of manufacturing, will assume full charge of Continental's eight refineries.

Mr. Miller

Dr. Miller came to this country from Switzerland as a small boy and his first connection with the oil industry here was as a yield clerk at the Bayonne, N. J., refinery of Tide Water Oil Co. in 1909. After reaching the position of process superintendent, he resigned to join the Pierce Refining Co., Tulsa, as general superintendent of its three refineries. In 1921 he took charge of Marland Oil Co.'s refining operations and when Marland and Continental Oil Co. merged in 1929 he continued as vice president in charge of manufacturing. In 1943 he was awarded an honorary degree of Doctor of Engineering by Tulsa University.

o o o

Philip S. Magruder, manager of manufacturing, General Petroleum Corp. has been elected a vice president of the company. He joined the company in 1925 as gas tester, later became superintendent of the gas department and in 1942 was made manager of that department. In 1945 he was elected a director and made head of the manufacturing department.

Mr. Magruder was one of the organizers of the California Natural Gasoline Assn., has served on various committees and was president in 1939-40.

o o o

S. A. Montgomery, manager of the Whiting refinery of Standard Oil Co. (Indiana) has been promoted to assistant general manager of manufacturing and will be located in Chicago. He joined the company in 1919 as a chemist at Whiting.

Mr. Montgomery

Dr. J. W. McGill succeeds Mr. Montgomery as manager of the Whiting plant. He has been manager of the Wood River refinery. He first came with the company in 1924 as a chemist at Whiting.

Dr. G. F. Ordeman becomes manager at Wood River, succeeding Dr. McGill. He was assistant general superintendent at Whiting. He also first came with the company in 1919 as a chemist at Whiting.

o o o

A. F. Endres, who has been superintendent of the light oils division at Whiting, will be assistant general superintendent there. He started with the company in 1923 as a chemical engineer.

o o o

P. C. Keith, head of Hydro-Carbon Research, Inc., New York, was one of a group of eight scientists receiving the Army's Medal for Merit for "scientific distinction in connection with the development of the greatest military weapon of all time, the atomic bomb". As the active head of the Kellex Corp., of the M. W. Kellogg Co., Mr. Keith directed the development, design and engineering of the gas diffusion plant for the separation of Uranium 235, an essential ingredient of the atomic bomb, the citation reads. Hydro-Carbon Research Inc., with which Mr. Keith is now connected, has carried on extensive work in the application of the Fischer-Tropsch process to the synthesis of natural gas.

Mr. Keith

TECHNICAL MEETINGS FOR OIL MEN

APRIL

8-5, Society of Automotive Engineers, spring meeting (Aeronautic), Hotel New Yorker, New York.
8-12, American Chemical Society, 109th meeting, Atlantic City.
17-19, Natural Gasoline Association of America, annual meeting, Baker Hotel, Dallas.
18-19, National Petroleum Association, semi-annual meeting, Hotel Cleveland, Cleveland.
22-27, 1st National Exposition of the Plastics Industry, sponsored by the Society of the Plastics Industry, Grand Central Palace, New York.
28, American Petroleum Institute directors' meeting, Blackstone Hotel, Fort Worth.
29-May 1, Independent Petroleum Association of America, midyear meeting, Houston.

MAY

7-8, American Gas Association, Natural Gas Department, annual spring meeting, Hotel Gibson, Cincinnati, Ohio.
7-9, National Association of Corrosion Engineers, annual meeting, President Hotel, Kansas City, Mo.
15-17, American Oil Chemists Society, annual meeting, Roosevelt Hotel, New Orleans.

JUNE

2-7, Society of Automotive Engineers, semi-annual meeting, French Lick Springs Hotel, French Lick, Ind.
24-28, American Society for Testing Materials, annual meeting, Statler Hotel, Buffalo.

SEPTEMBER

9-13, American Chemical Society, 110th meeting, Chicago.
10-14, 4th National Chemical Exposition, Coliseum, Chicago.
16-20, National Instrument Conference, sponsored by Instrument Society of America, William Penn Hotel, Pittsburgh.
29-Oct. 2, National Lubricating Grease Institute, 14th annual meeting, Edgewater Beach Hotel, Chicago.

OCTOBER

7-12, American Gas Association, annual meeting, Atlantic City.

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WIDENING HORIZONS

Views on Personnel, Management and Economic as Well as Technological Developments in Petroleum Refining and Natural Gas Processing: Comment from Readers Is Invited

Inform Public on Oil Research In Peacetime as Well as in War

OIL and other industrial research played an important part in winning the first World War, though its contribution was small indeed when compared with the achievements in the war just ended. After the first war, however, the research staffs in most cases retired gladly enough to their workshops to resume their peacetime projects. Their laboratories for the most part were removed from other company activities. Company management knew little enough of what was going on there and the public was told little or nothing of this important phase of a company's affairs.

Fortunately for the nation, industrial research did go on, and was even greatly expanded, in the interim between the wars. When war broke out anew it was the technological developments resulting from earlier research that made possible high-octane gasoline, toluene for explosives and synthetic rubber, to mention a few essential wartime products supplied by the oil industry.

Serious mistakes occurred in the conduct of the second war, however, in part at least because the public at large had no conception of the scope and importance of industrial research even in a peacetime economy. Lacking this understanding, it could not grasp the part research would be called on to play in the second war. Now, with the lessons of the war recently ended fresh in our minds, and with the alarms of war still sounding, it is not too early to consider the steps that industrial research should take to avoid the mistakes made in this war.

It seems plain at the start that research staffs cannot now retire to their workshops and close the doors, assuming the public has no interest in what goes on there except as it becomes needed in the national defense. Speaking for our own industry, it seems evident that the oil companies should give their development work the same degree of public attention they give their sales and manufacturing departments. The laboratories and proving grounds may be located at out of the way spots on company grounds but the companies themselves should be continually calling attention to the work that goes on there, the large number of men at work, and other facts that will keep before the public the extent and value of peacetime industrial research.

For example, if the public is kept informed on this subject it undoubtedly will guard against promiscuous drafting of research workers into the armed forces at the start of a future war. Had there been any general understanding, at the outbreak of war in 1941, of the number of men in industry engaged in research, and the importance of their work in the war program, it is doubtful if the public would have stood for the drafting of highly trained scientific workers who could not be replaced in their work. These men would have been recognized as far more important to the winning of the war if kept at their research duties.

However well-intentioned were the men who drafted the Selective Service Act and however well-intentioned the draft boards who administered it, the real facts were that far too many chemists, physicists and engineers were put into uniform and lost to research. Any future war will need the mobilizing of research work before armed forces take to the field, for warfare will be even more technological than in the past, and research staffs must be spared.

It is true that the public is conscious of the role played by scientific developments in winning this war as it was not at the end of the first war. However, there are today many interests that constantly try to play down the part that industrial research took in the program. Government sponsored research would like to hold the spotlight. There are many who honestly, or for selfish reasons, advocate socialized scientific development programs. They cast doubt upon the value to the public of industrial research. They would emasculate or destroy the patent system under which our great technological development has taken place. Too often the silence of industry in presenting its own case has been taken as evidence that industry's program was not in the public interest. How can the public hear the case of industry and its contribution to scientific research except from the scientific leaders in industry? How can the public be impressed with the importance of this work, except through the top management of oil companies and those in other industries that carry on the research being continually articulate on the subject?

Public understanding of the scope and importance of industrial research both to the public welfare and in any military preparedness program also might act as a brake against too drastic changes in the patent system, as are now proposed. It also might aid in removing some of the burden of unfair taxation now imposed on research activities.

The philosophy of the day among the social theorists is that new discoveries and inventions should be public property. It is proposed in the measures before Congress for a government directed research program that any inventions or discoveries resulting from projects financed in any way by the government shall become the property of the U. S. Aside from unfairness to the inventor, such a policy would tend to handicap the further work and improvement on new discoveries which in most cases has to take place before they are commercially practicable. Private enterprise can hardly be expected to carry on this often long and costly development work without some incentive of patent rights. Technological progress might be handicaped in peacetime years on projects vital to national defense in the case of another war. Giving the public the factual story of peacetime industrial research, might be an effective way to present industry's side on the question of changes in the patent system.

The existing inequities in the taxation of research institutions and the uncertainties as to the attitude of the Internal Revenue Bureau in the matter of deduction of research and development expenses, result from too little public understanding in the matter. Their effect, however, is too often a deterrent on industrial research work, particularly by new concerns. Better understanding of the scope and importance of industrial research in the peacetime years might bring the weight of public opinion against these tax inequities.

Industrial scientists of the nation, through their achievements in this war, have attained a position of leadership in national affairs, whether they desire it or not. With this leadership goes the responsibility of keeping the public informed on issues vital to the full participation of industrial research in our national defense program.

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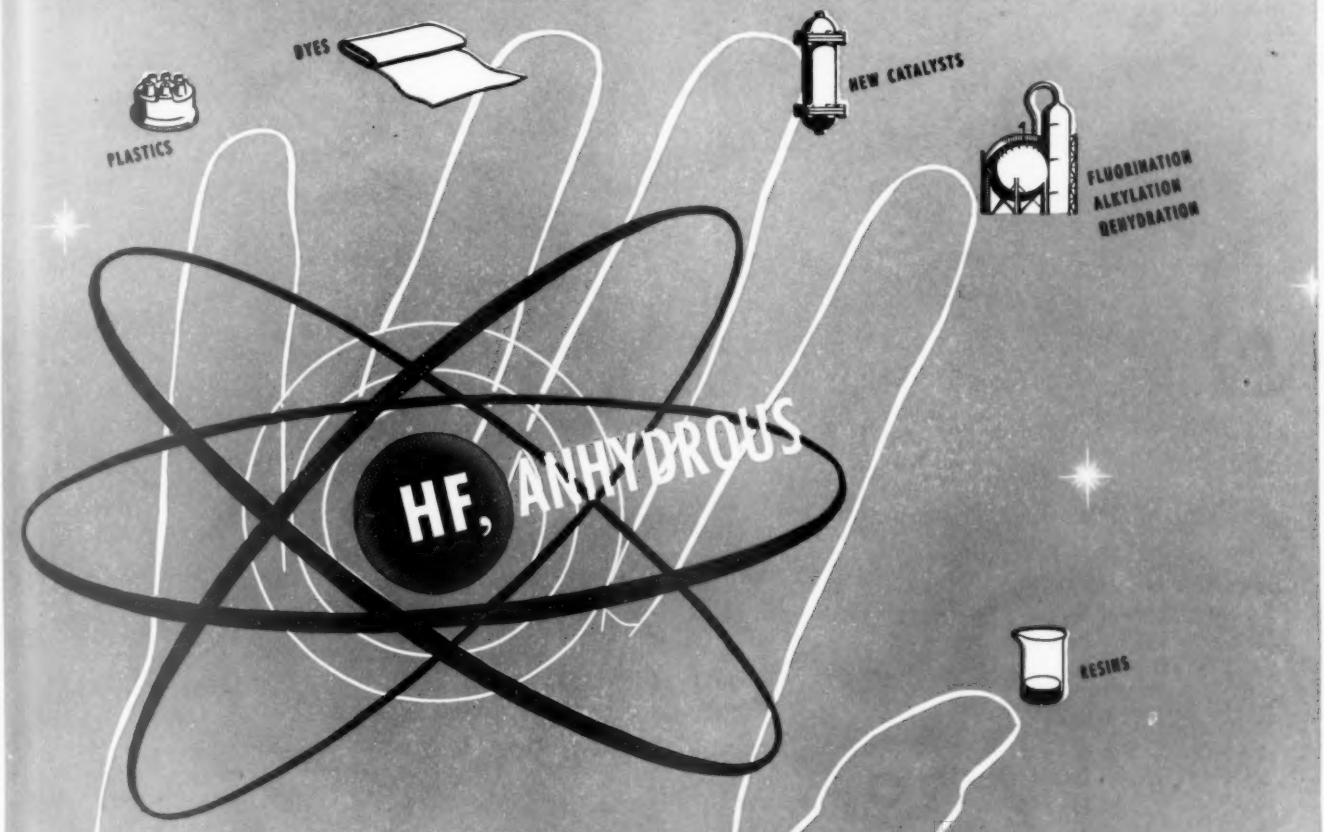

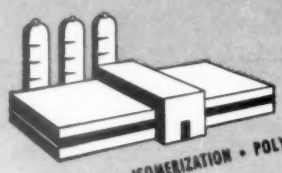

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